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Carotid Endarterectomy and Race

Do Clinical Indications and Patient Preferences Account for Differences?

Eugene Z. Oddone, MD, MHSc; Ronnie D. Horner, PhD; Dean C.C. Johnston, MD, MHSc; Karen Stechuchak, MS; Lauren McIntyre, PhD; Aileen Ward, RN, MSN; Linda G. Alley, RN, PhD; Jeff Whittle, MD; Laura Kroupa, MD; John Taylor, MD

Background and Purpose—Carotid endarterectomy (CE) has been proved to reduce the risk of stroke for certain patients, but black patients are less likely than whites to receive CE. The purpose of this work was to determine the importance of clinical indications and patient preferences in predicting the use of carotid angiography and CE in a racially stratified sample of patients.

Methods—Between 1997 and 1999, 708 patients with at least 1 carotid artery containing a $\geq 50\%$ stenosis were enrolled (617 whites, 91 blacks) from 5 Veteran Affairs Medical Centers. Patient interviews were conducted at the time of the index carotid ultrasound, and each patient was followed up for 6 months to determine clinical events and receipt of carotid angiography or CE.

Results—Black and white patients were similar in terms of age, sex, education level, and social support. More black than white patients received ultrasound for a completed stroke (36% versus 13%), and fewer black patients were classified as asymptomatic (56% versus 70%) or as having had a TIA (8% versus 17%; $P < 0.001$). Health-related quality of life scores, trust in physician, and medical comorbidity scores were similar for black and white patients. Black patients expressed higher aversion to CE than white patients (31% versus 15% in the highest aversion quartile for blacks and whites, respectively; $P = 0.01$). During follow-up, 20% of white patients and 14% of black patients received CE ($P = 0.19$). In adjusted analyses, only patient clinical status as it relates to the indication for CE and site were associated with receipt of CE.

Conclusions—Contrary to prior research, patient's race was not associated with receipt of invasive carotid imaging or CE for older male veterans. These findings persist after controlling for patient preferences, comorbid illness, and quality of life. For patients enrolled in an equal-access healthcare system, clinical status was the primary determinant of the receipt of CE. (*Stroke*. 2002;33:2936-2943.)

Key Words: carotid endarterectomy ■ racial differences

Black patients are at higher risk of stroke than white patients, and current reports indicate that stroke mortality among blacks may be increasing.¹⁻⁴ Carotid endarterectomy (CE) is known to reduce stroke rates in patients with high-grade carotid artery stenosis and symptoms referable to that stenosis.⁵⁻⁸ Asymptomatic patients may also benefit from CE.⁹ In prior reports, however, black patients were only one half to one quarter as likely as white patients to receive this procedure.¹⁰⁻¹³

There is no clear explanation for why this racial difference in the use of this effective procedure exists, although this understanding is required before any intervention to reduce the apparent disparity can be tested. Determining whether

racial group differences in CE use are due to underuse in 1 group, overuse in 1 group, or neither could provide greater understanding to help guide further interventions designed to reduce the disparity. Reports have shown that clinical differences at the time of patient presentation explain some of the racial difference in CE rates. For example, blacks are less likely to present with high-grade extracranial carotid atherosclerosis compared with whites.^{14,15} Additional information is necessary to understand better the contribution of other factors. Possible reasons for the observed disparities include differential access to care, differences in clinical features of the disease, differences in workup and referral for diagnostic testing, differences in the use of invasive carotid imaging to

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From the Center for Health Services Research in Primary Care, Durham VAMC, and Division of General Internal Medicine, Duke University Medical Center (E.Z.O., R.D.H., A.W.); Centre for Health Evaluation and Outcome Sciences, St. Paul's Hospital and the University of British Columbia, Vancouver, Canada (D.C.C.J.); Computational Genomics, Purdue University, West Lafayette, Ind, and Division of Biometry and Bioinformatics, Duke University Medical Center, Durham, NC (L.M.); Atlanta VAMC and the Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, Ga (L.G.A.); Pittsburgh VAMC, Pittsburgh, Pa (J.W.); St. Louis VAMC, St. Louis, Mo (L.K.); and Hunter Holmes McGuire VA Medical Center, Richmond, Va (J.T.).

Correspondence to Eugene Oddone, MD, MHSc, Center for Health Services Research in Primary Care, VAMC, Durham NC 27710. E-mail oddon001@mc.duke.edu

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define better operative candidates, provider bias, or differences in patient preferences for CE as a mode of treatment.¹⁶

In this report, we present the findings from a study designed to determine the degree to which differences in clinical indications and patient preferences for CE explain the observed racial difference in use of the procedure. We conducted this study with a group of patients who were being considered for the procedure because of the presence of carotid artery stenosis. Thus, the decisions facing the patients and their providers were real and determined before the procedure. Moreover, we conducted the study in the Veterans Affairs (VA) healthcare system because patients confront few financial barriers to diagnostic evaluation and treatment, thereby reducing the likelihood that this factor would be a confounder of any observed association.

Methods

Setting and Subjects

The study was conducted at 5 VA Medical Centers: Atlanta, Durham, Pittsburgh, Richmond, and St Louis. Patients were enrolled after a carotid ultrasound/Doppler study. Black and white patients were eligible for the study if the ultrasound revealed at least a 50% stenosis in a carotid artery, thereby identifying them as potential candidates for invasive testing (ie, carotid angiography) and possibly CE. All patients provided written, informed consent. The Research and Human Subjects Committees approved the study at each of the 5 medical centers.

Between September 1, 1997, and September 30, 1999, we screened 4677 patients who received a carotid ultrasound. Of these, 708 patients had at least 1 carotid artery with a $\geq 50\%$ stenosis and were enrolled in the study. Medical record review and ascertainment of symptom status were completed for 89 of the 91 black patients (98%) and for 607 of the 617 white patients (97%) enrolled in the study. Six-month follow-up contacts were completed for 662 of the 708 study patients (94%), and there was no difference in follow-up by race.

Of the 3969 patients who were not enrolled, 2726 (69%) were excluded because they had $<50\%$ stenosis in both carotid arteries. Other reasons for exclusion included the following: 577 patients (15%) who had had CE, 274 patients (7%) with poor mental status, 46 patients ($<1\%$) who were neither white nor black according to patient self-report, and 152 for other reasons. Additionally, 194 patients (4% of those approached) were otherwise eligible but refused to participate. Of these patients, 167 (86%) were white and 27 (14%) were black.

Measures Obtained From Patients

At the time of the index ultrasound, we conducted face-to-face interviews to determine patient responses in several psychosocial domains. Race was determined by self-report during this interview. Other measures are summarized below.

Patient Aversion to CE

To determine patient preferences for and potential aversion to CE, we used their responses to a modified standard gamble experiment that we developed previously in a different veteran population.¹⁷ Briefly, the interviewer described a hypothetical situation in which the patient was placed in a high-risk category for having a stroke. The patient was then asked to choose between 2 treatments that could reduce his risk of stroke: CE or a painless pill. After a description of CE, the patient was informed that with surgery, there was a 5% chance of immediate death and a 95% chance of living another 10 years in the current state of health. The alternative to CE was taking the hypothetical pill 1 time in the doctor's office. This pill would have the same outcome as a successful surgery (ie, 10 years in the current health status) but with a varying chance of immediate death. Initially, the patient was asked to choose between having the surgery

with a 5% chance of death and taking the pill with a 50% chance of death. Depending on the answer, the patient was then asked a series of questions in which the chance of death changed by 10% with each iteration until the patient was indifferent between choosing surgery at a 5% chance of death and choosing the pill. The probability value at which the patient was indifferent (P_i) indicates the chance of death with the pill the patient is willing to accept to avoid surgery with a fixed chance of death of 5%. If the patient switched preferences between iterations of the questions, he or she was assigned a P_i halfway between the 2 values, yielding a possible range of P_i from 0.025 to 0.975. Aversion to CE, or the excess risk of death the patient is willing to accept to avoid surgery, was therefore defined as $P_i - 0.05$. This variable was separated into quartiles (an a priori decision) determined from the entire study cohort to allow a relative comparison of patients with higher versus lower aversion levels.

Trust in Physician

To assess a patient's interpersonal trust in the clinician responsible for discussions concerning evaluation for CE, we used the Trust in Physician Scale, an 11-item, validated questionnaire.^{18,19}

Prior Surgical Experience

To capture the patient's previous experiences with surgery, we created a dichotomous variable based on the patient's personal experience with surgery. The variable had a value of 1 if the patient had any prior surgery and a value of 0 otherwise.

Health-Related Quality of Life

Because a patient's current quality of life may affect decisions about therapeutic choices concerning surgery, we measured general health-related quality of life using the Medical Outcomes Study SF-12.²⁰ For the adjusted analyses, we used patient responses to a single question concerning general health status.

Measures Obtained From the Medical Record

Neurological Status

Clinical status (asymptomatic, transient ischemic attack [TIA], or stroke) was determined through medical record abstraction at the time of the carotid ultrasound with a modified protocol based on the RAND method.²¹ For patients with stroke, we also abstracted information necessary to classify the stroke subtype (VA Trial of Org 10172 in Acute Stroke Treatment [TOAST] algorithm) and stroke severity (modified Canadian Neurologic Scale).^{22,23} For stroke subtype, we used a modified form of the original TOAST algorithm that has been validated for medical record and healthcare use review.²²

Appropriateness for CE

Of the 3 available guidelines used to judge the appropriateness of CE (the Ad Hoc Committee of the Joint Council of the Society for Vascular Surgery, American Stroke Association, and RAND guidelines),^{21,24,25} we chose to apply the RAND guidelines because they can be used to classify patients preoperatively. These guidelines are based on the ratings of a multidisciplinary expert panel and classify patients as appropriate, inappropriate, or uncertain candidates for CE. The clinical information used to make these judgments is based on a combination of symptom status (stroke, TIA, or asymptomatic), degree of ipsilateral and contralateral carotid artery stenosis, and operative risk. The RAND guidelines have high test-retest reliability and content validity.²⁶ Moreover, these specific panel ratings are internally consistent with incremental survival estimates generated from a decision analytical model comparing CE to medical therapy.²⁷ Finally, the RAND guidelines yielded recommendations consistent with recommendations derived from randomized, controlled trial evidence.

Comorbid Illness

We used the validated Charlson Comorbidity Illness Index as a measure of overall comorbidity.²⁸ We also measured individual medical illnesses that defined the patient's risk profile for stroke (eg, atrial fibrillation, diabetes, hypertension).

Outcomes

Our primary outcome was the receipt of either carotid angiography or CE within 6 months of the carotid ultrasound. Secondary outcomes included TIA, stroke, or death at 6 months. Determination of both the primary and secondary outcomes occurred through screening of existing VA healthcare files (medical record and hospital computer files), or in the case of patient death, we relied on proxy respondent.

Statistical Analysis

Black and white patients were compared for baseline characteristics by use of a χ^2 test for categorical variables and Wilcoxon's rank-sum test for continuous variables. The level of statistical significance for the main comparisons was set at $P < 0.05$ because our hypotheses were developed a priori. Our primary hypothesis specified that the use of either invasive carotid artery testing or CE within 6 months of enrollment is a function of patient aversion to CE. The receipt of CE or carotid angiography was initially modeled through logistic regression. We also performed an additional analysis to determine whether the use of CE alone was related to patient race after adjusting for the following baseline characteristics: RAND appropriateness, aversion to CE, surgical experience, self-rated health, medical comorbidities, and site. Clinical variables were chosen for inclusion in the adjusted model on the basis of our a priori hypothesis of the importance of the variable in clinical decisions concerning CE. Site was retained in the model because there were site differences in the baseline characteristics and frequency of receipt of CE or CA. In general, site differences were strongly associated with baseline clinical variables such as neurological status. To examine whether race interacted with other baseline characteristics, specifically appropriateness, aversion to CE, and site, a χ^2 test was performed.

Results

Baseline Patient Characteristics

As shown in Table 1, black and white patients differ in only a few characteristics. A greater proportion of black than white patients received ultrasound for a completed stroke (36% versus 13%, $P < 0.001$), and fewer blacks were classified as either asymptomatic or as having had a TIA. A greater proportion of black patients had hypertension, whereas a greater proportion of white patients had prior myocardial infarction, atrial fibrillation, and peripheral vascular disease. Baseline systolic and diastolic blood pressures were similar in both racial groups. Overall, comorbid medical illness as measured by the Charlson Index did not vary by race. It is notable that $\approx 40\%$ of patients of both races had a Charlson Index score of ≥ 3 , implying a significant degree of comorbid illness in this cohort. Patients' prior experience with surgery, however, did vary by race. Overall, 87% of white patients compared with 73% of black patients reported having had surgery before enrollment ($P < 0.001$).

For patients with stroke as the primary indication for the carotid ultrasound, 38% were deemed to be atherothrombotic in origin, 3% were cardioembolic, and the remaining 62% either were unclassified or had insufficient information to determine a cause with the TOAST classification system. Eleven percent of patients with stroke were deemed to have a moderate or severe stroke rating based on the Canadian Neurologic Scale. Neither stroke subtype nor severity varied by race.

Aversion to CE

Aversion scores are shown in Figure 1. Aversion scores for blacks were higher than for whites ($P = 0.003$). This result

TABLE 1. Demographic and Clinical Characteristics of Study Patients

	White (n=617)	Black (n=91)	P
Demographics			
Age, median (IQR)	70.0 (10.0)	69.0 (12.0)	0.10
Male, %	98.4	100.0	0.38
Education, % completed high school or more	64.4	59.3	0.41
Living status, % alone	24.9	31.9	0.16
Enrolled as inpatient, %	20.0	21.1	0.89
Baseline neurological status, %			<0.001
Stroke	13.1	35.6	
TIA	17.2	8.1	
Asymptomatic	69.8	56.3	
Comorbid medical illness			
Hypertension, %	78.6	86.8	0.07
Systolic BP, median (IQR)	144.0 (31.0)	138.0 (29.5)	0.13
Diastolic BP, median (IQR)	74.0 (17.0)	74.0 (15.0)	0.32
Diabetes, %			
No end-organ damage	13.3	17.6	0.33
End-organ damage	19.6	27.5	0.10
Myocardial infarction, %	33.9	15.4	<0.001
Atrial fibrillation, %	10.7	3.3	0.04
Peripheral vascular disease, %	45.4	33.0	0.03
Charlson Index, %			0.98
0	15.6	16.5	
1	23.2	23.1	
2	20.3	18.7	
3 or more	41.0	41.8	
Functional measures, median (IQR)			
SF-12: Mental Component Score	54.8 (12.4)	54.5 (10.7)	0.47
SF-12: Physical Component Score	36.8 (20.1)	37.5 (17.0)	0.81
Trust in physician	1.7 (1.0)	1.8 (1.0)	0.31
Previous surgical history (self-reported), %			<0.001
CABG	15.8	13.2	
Any surgery	71.6	59.3	

IQR indicates interquartile range; BP, blood pressure; SF-12, Medical Outcomes Study Short Form 12; CABG, coronary artery bypass graft.

occurred because black patients showed a bimodal distribution, with $\approx 31\%$ of their responses in the highest aversion quartile compared with 15% for whites.

Appropriateness for CE and Operative Risk

RAND appropriateness ratings are shown in Figure 2. Black and white patients had a similar distribution of summary appropriateness scores for CE ($P = 0.44$). Approximately 40% of patients were considered inappropriate for the procedure, 8% were of uncertain appropriateness (ie, the benefits did not clearly outweigh the risks), and 51% were deemed to be appropriate candidates for CE. Although RAND appropriateness ratings are based on anticipated operative risk estimates, we also measured variables that would allow us to stratify

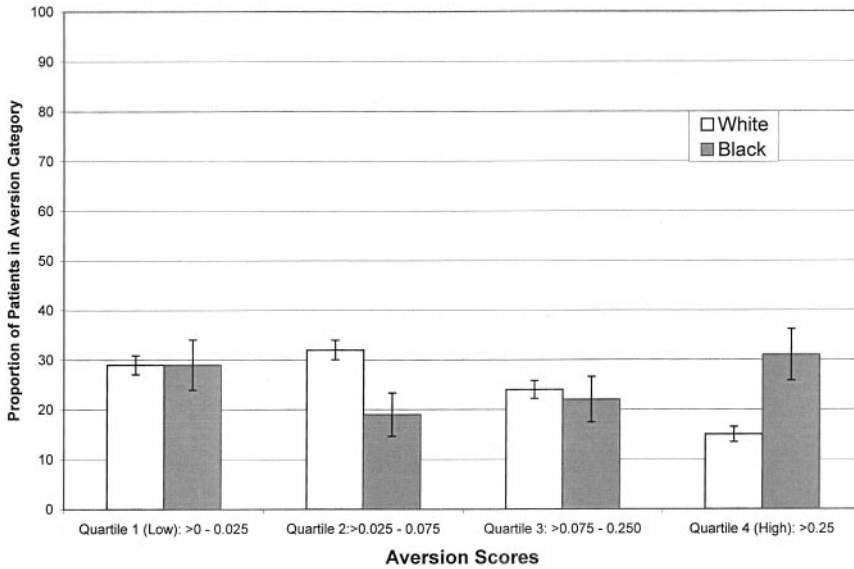


Figure 1. Aversion to CE scores collapsed into quartiles. Distribution of scores differs by race ($P=0.003$). Marks surrounding bars denote \pm SE.

patients by risk according to an alternative validated measure.²⁹ Overall, 15% of black patients and 29% of white patients ($P=0.008$) were in the higher risk stratum for CE.

Receipt of Carotid Angiogram or CE

In unadjusted analyses, there were no statistically significant racial differences in receipt of either invasive carotid angiography or CE. Twenty percent of white and 17% of black patients received a carotid angiogram ($P=0.48$). Twenty percent of white and 14% of black patients received CE ($P=0.19$). Overall, 30% of white and 23% of black patients received either carotid angiography or CE within 6 months of the index ultrasound ($P=0.17$).

When patients were separated into their appropriateness categories, approximately one third of patients deemed appropriate candidates received CE (Table 2). A small proportion of patients for whom the procedure was deemed to be of

uncertain appropriateness and only 7 patients for whom it was deemed to be inappropriate (<3%) received CE. There was no difference by race in receipt of CE within appropriateness categories. For patients who were classified as appropriate for CE but did not receive it, 69% of whites and 67% of blacks were asymptomatic.

Clinical Status at Follow-Up

Within 6 months of the index ultrasound, 32 patients died. Thirty-one were white (5% of all white patients), and 1 was black (1% of all black patients). The differences in death rate by race were not statistically significant ($P=0.16$). An additional 14 patients experienced a stroke (14 white and 0 black patients).

Adjusted Analyses

After adjustment for several different patient characteristics, only RAND appropriateness rating and site were associated

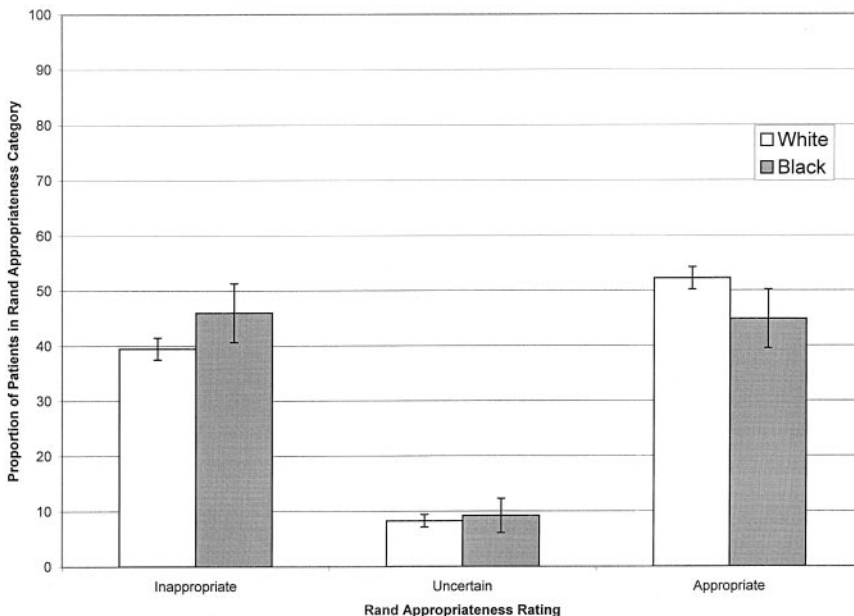


Figure 2. RAND appropriateness ratings for CE. Distribution of appropriateness ratings does not differ by race ($P=0.44$). Marks surrounding bars denote \pm SE.

TABLE 2. Receipt of CE According to RAND Appropriateness Rating for Study Patients

Status	White* (N=593)	Black* (N=84)	P
Appropriate candidate	309 (52%)	38 (45%)	0.59
Received CE†	34%	29%	
Uncertain candidate	50 (8%)	8 (9%)	1.0
Received CE	16%	13%	
Inappropriate candidate	234 (40%)	38 (46%)	0.60
Received CE	3%	0%	

*Number in column reflects the number of patients in the category (percent of patients of that race in category).

†Proportion of patients within the appropriateness category who received CE.

with receipt of CE (Table 3). Compared with inappropriate candidates, patients who were classified as uncertain were ≈ 9 -fold more likely and appropriate candidates were ≈ 28 -fold more likely to receive CE. Aversion to the procedure was

not associated with receipt of CE ($P=0.13$). Patients in the highest quartile of aversion score (those who indicated the greatest aversion to the procedure), however, were only 40% as likely to receive CE during follow-up compared with those in the lowest quartile of aversion. Race was not an important predictor of CE. When we redefined the outcome variable as receipt of either carotid angiography or CE, race was still not an important predictor (data not shown).

Discussion

This is the first study designed to determine the underlying cause of racial differences in receipt of CE by examining a comprehensive array of possible explanatory factors in a prospective cohort study. By enrolling patients after a carotid ultrasound, we assembled a cohort determined according to the decision process the patients face concerning their evaluation for CE. This inception cohort was not defined by the natural history of the disease but by the natural history of the decision process. We found that black and white patients

TABLE 3. Predictors of CE for Patients With $\geq 50\%$ Stenosis in a Carotid Artery

	Unadjusted		Adjusted Model*	
	OR (95% CI)	P	OR (95% CI)	P
Rand appropriateness rating		<0.0001		<0.0001
Inappropriate	1.0		1.0	
Uncertain	8.1 (2.8, 23.9)		8.8 (2.9, 26.6)	
Appropriate	22.3 (9.6, 51.5)		28.8 (11.8, 69.9)	
Aversion score		0.25		0.13
Quartile 1	1.0		1.0	
Quartile 2	0.9 (0.5, 1.5)		0.9 (0.5, 1.7)	
Quartile 3	1.0 (0.6, 1.7)		0.8 (0.5, 1.6)	
Quartile 4	0.5 (0.3, 1.0)		0.4 (0.2, 0.9)	
Race		0.18		0.91
Black	1.0		1.0	
White	1.6 (0.8, 2.9)		1.0 (0.5, 2.2)	
Surgical experience		0.66		0.70
None	1.0		1.0	
Any	0.9 (0.5, 1.5)		0.9 (0.4, 1.7)	
Self-rated health		0.35		0.24
Excellent or very good	1.0		1.0	
Good	0.6 (0.4, 1.2)		0.6 (0.3, 1.2)	
Fair or poor	0.8 (0.5, 1.4)		0.8 (0.4, 1.6)	
Charlson Comorbidity		0.03		0.16
None	1.0		1.0	
1	2.0 (1.0, 3.9)		2.1 (1.0, 4.6)	
2	0.9 (0.4, 1.9)		1.1 (0.4, 2.6)	
3+	1.5 (0.8, 2.9)		1.5 (0.7, 3.2)	
Site		0.16		0.01
Atlanta, Ga	1.0		1.0	
Durham, NC	0.7 (0.4, 1.3)		0.3 (0.1, 0.7)	
Pittsburgh, Pa	1.1 (0.6, 2.0)		0.3 (0.1, 0.6)	
Richmond, Va	0.5 (0.3, 1.0)		0.4 (0.2, 0.8)	
St. Louis, Mo	0.9 (0.5, 1.5)		0.4 (0.2, 0.9)	

*Adjusted for all variables in table. Model C-statistic 0.8.

were equally likely to receive CE. Furthermore, adjusting for clinical indications, patient preferences, and other potential explanatory factors did not change the results. In this cohort, patients received CE on the basis of the array of factors that define appropriate use of the procedure. Of particular importance, we found that the primary indication of whether a patient received CE was clinical appropriateness and not race.

CE plays a unique role among invasive surgical procedures. It is the established treatment of choice for patients with symptoms referable to anterior carotid circulation atherosclerosis (minor completed stroke or TIA) and ipsilateral carotid stenosis.^{5–8} Randomized trials have also shown its efficacy in asymptomatic patients with high-grade stenosis in a carotid artery, although concerns about generalizability persist.^{9,30} Guidelines from the American Stroke Association support use of CE in several situations.²⁵ Indeed, annual use of CE has risen sharply over the last several years.³¹ CE, however, is different from many vascular procedures in that it does not relieve pain or prolong life. It is performed to reduce the risk of future stroke or TIA. This can be a difficult concept to explain to patients. Also, variation in enthusiasm for CE exists among providers, both generalists and specialists. Therefore, the messages patients receive about the usefulness of CE may be different, depending on the provider. Additionally, the risk of complications during the procedure is a critical variable that determines whether CE will confer true benefit to patients.³² Many providers do not know the complication rate at their institution, and local enthusiasm may vary accordingly.³³ All of these issues have an impact on and can complicate discussions between patients and providers when CE is considered as a means to reduce stroke risk.

Several previous studies, many of which identified patients from large administrative databases, have shown that black patients receive CE at significantly lower rates than white patients do.^{10–13} The white-black relative rate difference for receipt of CE approached 4:1 in some of these studies, making racial disparities in the relative rate of CE use one of the highest reported for an invasive procedure. Many of these studies, however, could not control for true clinical indications for the procedure. In this study, we identified patients on the basis of their receipt of a carotid ultrasound. Thus, we were able to characterize better the clinical indications for CE and to determine potential differences in the rates of CE after controlling for the clinical status of the patient. We were also able to make supplemental assessments of psychosocial and clinical variables that might influence either the patients' or providers' decisions to choose CE as an option for stroke risk reduction. Our study included a unique measure of patient preference for CE, comorbid illness, quality of life, and the influence of the patient's prior experience with surgery. We also measured these variables at a time when patients were faced with a real decision concerning CE. We found racial differences in patient aversion to CE and in their prior experience with surgery. Black patients were more averse to surgery and had less prior experience with it. Despite these differences, these factors did not appear to influence the use of either invasive carotid imaging (an important step in evaluation for CE in some centers) or CE itself. Clinical indication for

CE as measured by the RAND appropriateness rating, not race, was the dominant factor in predicting use of CE.

Our findings do not negate the breadth of information documenting racial disparities in the access and use of other procedures. The receipt of invasive procedures known to improve outcomes for patients with coronary artery disease has been repeatedly shown to vary by race.^{34,35} One study that did control for clinical factors showed that the differential receipt of revascularization procedures explained racial differences in patient survival.³⁶ Disparities also exist for the use of joint replacement,³⁷ surgical treatment for bronchogenic cancer,³⁸ and use of renal transplantation.³⁹ These racial disparities appear to be robust even when information on clinical stage and clinical indication for the procedure is included in the analysis. Our findings underscore the importance of obtaining a complete picture of clinical indication and potentially patient preferences before intense interventions are implemented to reverse perceived disparities. Racial disparities in the use of procedures determined solely from administrative databases should not be used to define policy interventions.

We have confidence in our findings for 2 main reasons. First, patients enrolled in this study received their care in an equal-access healthcare system. Thus, financial disparities between patient groups did not limit their access to or use of procedures. We recognize, however, that this cannot explain the complete lack of disparity because previous studies within the VA have shown persistent racial differences, even after accounting for some clinical differences.^{13,40,41} Second, all patients in this study were enrolled after a noninvasive evaluation of their carotid arteries. This allowed us to make complete assessment of patient appropriateness for CE using clinical symptoms and degree of stenosis. Furthermore, it ensured that carotid atherosclerosis was being considered as a potential explanation for the patient's symptoms.

Although not a specified hypothesis in this study, we did observe potentially clinically important differences in outcome that did not achieve statistical significance. Specifically, 5% of white patients but only 1% of black patients died within the 6-month follow-up period. Other studies have reported survival advantages for older black patients discharged from VA hospitals.⁴² This has been explained in terms of the "survivor effect." We caution against overinterpretation of these outcome differences in the present study because the number of deaths was small relative to the number of patients in the study.

This study has several potential limitations. First, because it was conducted within the VA healthcare system, the vast majority of the patients were men, reflecting the sex distribution of older veterans. Thus, our results may not apply to women. Second, by enrolling patients before a potential CE, we may have somehow influenced their decisions concerning this procedure by asking the battery of questions that we did. Although the result of this bias could lead to more or less use of CE, there is no basis for assuming that it would influence patients of 1 race more than those of another. Third, by enrolling patients after a carotid ultrasound, we may have missed a potential source of disparity resulting from racial differences in patient referral to ultrasound. Finally, our

findings may reflect insufficient statistical power to detect small racial differences in receipt of CE. We were able to enroll only 91 black patients with >50% stenosis, and only 45% of these patients were deemed appropriate for CE. Although the adjusted odds ratio for race was 1.0, indicating no association, the 95% confidence interval surrounding the race odds ratio was 0.5 to 2.2.

Our findings also need to be interpreted in the context of the healthcare system in which the study was conducted. The VA is a unique system for studying potential racial disparities.⁴³ There are no financial barriers to care or financial incentives for physicians to deliver more or less care. Because the socioeconomic status of veterans is lower than for nonveterans, the VA also serves as a safety net for its patients. Understanding potential differences in access and use of care is therefore ethically important. Because of these system features, however, our findings may not be exportable to situations in which financial incentives for care are more pressing.

With due regard for these limitations, we conclude that racial disparities in the use of CE reflect differences in clinical indications and not inappropriate use by either blacks or whites. The reasons for racial disparities in the use of healthcare services are complex and may be explained by differences in clinical variables rather than by differences in patient preferences, comorbid illness, access to care, or trust in physicians. In this study, racial differences in the use of CE were explained by a clinical measure of the appropriateness of the procedure in individual patients and not by psychosocial variables, socioeconomic variables, or access to care. Further study is required to determine whether these results may be generalized to other procedures and to settings outside the VA healthcare system.

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