Carotid Endarterectomy in Elderly Patients

Low Complication Rate With Overnight Stay

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Hypothesis: Elderly patients undergoing carotid endarterectomy (CEA) can have a low complication rate and a short hospital stay.

Design: In this case series, we compared CEA results from January 1, 1994, through December 31, 1998, in 2 different age groups: 71 to 80 years and 81 years and older.

Setting: A private vascular surgery practice.

Patients: We studied 271 patients who underwent 293 CEA procedures; 124 procedures were for patients in the 71- to 80-year-old age group, and 42 procedures were for patients aged 81 years and older.

Interventions: Classic CEA was performed on all patients. From 1994 through 1996, 179 operations were performed under general anesthesia with routine shunting. In 1997 and 1998, 114 operations were performed under locoregional anesthesia with selective shunting.

Main Outcome Measures: Length of hospital stay and 30-day morbidity and mortality.

Results: The mortality rate for the entire series was 0.7% (2 of 293 patients). Major cardiac complications occurred in 3 patients (1.0%). Perioperative stroke occurred in 3 cases (1.0%); 2 strokes occurred in patients aged 71 to 80 years (2 [1.6%] of 124 patients), and 1 occurred in a patient aged 81 years or older (1 [2.4%] of 42 patients). Two additional patients developed reversible ischemic neurological deficits but were not in the elderly group (≥81 years and older). The mean hospital stay was 1.5 days for patients aged 71 to 80 years and 1.2 days for patients aged 81 years and older. All outcome variables were statistically similar in both age groups.

Conclusion: Octogenarians can undergo CEA with little morbidity and mortality and virtually an overnight hospital stay.

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STROKE REMAINS the leading cause of death in the United States, and its incidence and subsequent mortality increase with age. The results of the Asymptomatic Carotid Atherosclerosis Study and North American Symptomatic Carotid Endarterectomy Trial have validated the efficacy and benefits of carotid endarterectomy (CEA) to prevent stroke in patients with symptomatic and asymptomatic carotid artery occlusion.1 2 Consequently, CEA is currently the most common vascular surgical procedure performed in elderly patients.

See Invited Critique at end of article

However, previous studies have suggested that the complication rate may be higher and the length of hospital stay longer in this group of older patients.3-5 This creates a major dilemma, especially in view of the improved life expectancy in a constantly aging population. With this dilemma in mind, we reviewed and compared our CEA results from 1994 through 1998 in 2 different age groups.
nance angiography when compared with angiograms because the number of patients in our series who underwent both studies was too small to draw any scientific conclusions. All studies were read by the radiologist who performed them. The degree of internal carotid artery stenosis was determined in comparison to the widest diameter of the vessel. Review of the imaging results revealed that most internal carotid artery stenoses (63%) were greater than 80%.

All operations were performed by one of us (D.M.) using the classic CEA technique and with routine patching. From 1994 through 1996, 179 operations were performed under general endotracheal anesthesia, and with routine patching, without electroencephalographic monitoring or measurement of carotid stump pressure. In 1997 and 1998, 114 operations were performed under locoregional anesthesia (cervical block) with selective shunting based on the anatomy or the development of symptoms upon clamping. All operations were performed with systemic anticoagulation. When CEA was performed under general anesthesia, patients were routinely shunted and admitted to the intensive care unit for the first postoperative day. With regional anesthesia, patients were monitored in the postanesthesia care unit for 4 hours then transferred to the surgical floor if stable. The outcome variables measured included morbidity, mortality, and length of hospital stay and were determined for the entire series as well as for the 2 different age groups, aged 71 to 80 years and 81 years and older.

Data are reported as mean±SD or percentages. Differences in the proportions of categorical variables by age group (age, 71-80 years vs ≥81 years) were calculated using the Fisher exact test. Differences in length of stay by age group and by type of anesthesia were calculated using a t test. P≤.05 was considered statistically significant.

**RESULTS**

The mortality rate for the entire series was 0.7% (2 of 293 patients); 1 death occurred after a massive postoperative myocardial infarction and the other after a massive postoperative stroke. Neither of these patients were in the elderly group (age ≥81 years). The mortality rates in each age group (71-80 years, 0.8%; ≥81 years, 0%) were not statistically different.

Major complications occurred in 3.1% of the entire series, with no statistical difference between the 2 age groups studied (Table). Major cardiac complications occurred in 3 patients (1.0%), including 2 cases of postoperative congestive heart failure that resolved after appropriate treatment and 1 case of postoperative myocardial infarction that resulted in death. One patient had respiratory insufficiency postoperatively, which necessitated reintubation and delayed discharge. Early postoperative stroke, defined as a stroke occurring within 30 days postoperatively, occurred in 3 patients (1.0%). One stroke resulted in death; the other 2 patients, 1 of whom required a reoperation for thrombosis, made a complete recovery. In addition, 2 of these strokes occurred in patients in the 71- to 80-year-old age group (2 [1.6%] of 124) and 1 in a patient in the 81 years and older age group (1 [2.4%] of 42). Two additional patients developed a reversible ischemic neurological deficit but were not in the elderly group. Three patients developed transient cranial nerve deficits secondary to operative trauma to the hypoglossal or marginal mandibular nerves.

Local complications included 2 neck hematomas. One patient was taken back to the operating room for evacuation of the hematoma, and the other patient had airway compromise and significant tracheal deviation that persisted after emergent evacuation of the hematoma; the inability to intubate necessitated emergent tracheostomy.

Not including hospital stays of 5 days or longer secondary to the complications listed previously (7 operations), the mean length of stay was 1.3±0.7 days for the entire series. Most patients were discharged on the first postoperative day (218 [74.4%] of 293) (Figure 2). For the group aged 71 to 80 years, the mean hospital stay was 1.5±0.6 days, again not including hospital stays related to complications (5 patients). On the other hand, the mean hospital stay for patients aged 81 years and older was 1.2±0.7 days, not including complication-related stays (2 patients). There was no statistical difference between the 2 age groups.

When the distribution of hospital stay for patients aged 81 years and older is examined against the type of anesthesia (Figure 3), a trend toward shorter length of stay was noted when the operation was performed under locoregional anesthesia (1.0±0.2 days) vs general anesthesia (1.66±1.2 days), but the difference was not statistically significant. In our experience, CEA performed under regional anesthesia has not been associ-
in 1984 and 1985, Fisher et al noted a mortality of 4.7% for those older than 80 years (212 patients) as opposed to 1.1% for patients aged 65 to 69 years. They did note, however, that the nearly 80% of patients who underwent operations at hospitals performing 40 or fewer CEAs per year had a 3-fold increased risk of death compared with those who underwent surgery at high-volume hospitals. A correlation between age and operative mortality was also demonstrated in another more recent study among Medicare beneficiaries. In other recent hospital-based studies, mortality and sometimes stroke rates in elderly patients were found to be significantly higher than in younger patients. In a review of 11,763 CEAs performed over a 6-year period, Maxwell et al found a much higher mortality rate in patients older than 75 years (2.1%) compared with that in the younger cohort (0.9%). Riles et al performed a large retrospective study, spanning 3 decades and involving multiple surgeons at 1 institution, and found an increased risk of stroke and death in older patients who underwent CEA.

Our current series provides objective evidence that CEA is a safe procedure in elderly patients, with very low morbidity and mortality. The incidence of perioperative stroke in the subgroup of patients aged 81 years and older was quite low (2.4%). In fact, all outcome variables in the elderly patients’ group were statistically similar to those of the younger patients. This compares very favorably with several reports from individual institutions where CEA is performed on a regular basis and that have documented incidences of perioperative stroke ranging from 0% to 5.9% and low mortality among elderly patients. O’Hara et al report operative mortality and stroke rates of 1.6% and 1.8%, respectively, which is comparable to their results in a younger cohort. In a review of CEAs performed on patients aged 75 years and older, Perler and Williams and Perler et al noted that the incidence of perioperative neurological morbidity among elderly patients (4.8% in patients aged ≥75 years; 5.9% in patients aged ≥80 years) was not different from what they observed among all patients undergoing CEA, irrespective of age; they suggest that the indications for operation and the technical details of the procedure are far more relevant determinants of outcome than the patient’s chronological age. Our results, which are somewhat better, clearly support this conclusion.

Is the use of locoregional anesthesia a factor in reducing mortality and morbidity? We did not study that factor specifically as it relates to the incidence of perioperative complications, but we did note a trend toward shorter hospital stay and more hemodynamic stability with less need for an intensive care unit stay. Even though it would seem logical that, because of the reduced level of intervention, locoregional anesthesia would have substantial benefits for patients in terms of reduced cardiovascular and neurological complications, the results of many retrospective studies are conflicting and do not necessarily support that hypothesis. We do note though that most of the operations in the studies that showed high mortality and morbidity in the older patients were performed under general anesthesia. In the 3 perioperative mortalities in the series from the Ting et al, 2 developed fatal complications shortly after another operation following CEA, which suggests that multiple doses

Surgical endarterectomy remains the gold standard for the treatment of carotid artery stenosis that requires intervention. The decision to perform such a procedure must obviously balance the risk of stroke with medical treatment alone vs the risk with surgery. The American Heart Association defines the upper limits for combined postoperative mortality and stroke morbidity as 3% for asymptomatic patients, 5% for symptomatic patients, and 7% for patients who have suffered a previous stroke.

The overall incidence of stroke per 100,000 people is 1382 for those aged 75 to 84 years and 1824 for those aged 85 years and older. Only 52% of the former and 33% of the latter were alive 6 months after the event. With at least 60% of strokes being attributable to carotid atherosclerosis, it would seem that this group of elderly patients would benefit the most from CEA.

However, some investigators have found that very elderly patients have an increased operative risk. In a review of Medicare claim files from 2089 New England residents older than 65 years who underwent CEA...
of anesthesia may constitute a greater risk for this high-risk group of patients. There is accumulating evidence to suggest that locoregional anesthesia maintains cerebral autoregulation when compared with general anesthesia.\textsuperscript{24,29} Reduced shunt usage with locoregional anesthesia is well documented in the literature and is also supported in our experience.\textsuperscript{23,24,26} This clearly constitutes an added benefit because shunts can give rise to emboli, create intimal flaps, increase operative time, and may increase the technical difficulty of the endarterectomy.\textsuperscript{24} Other authors have demonstrated a statistically significant decrease in the mean time to hospital discharge.\textsuperscript{26,27} In the study by Papavasiliou et al,\textsuperscript{27} the hospital stay went from 3.5 days in the general anesthesia group to 1.3 days in the regional anesthesia group. Furthermore, in our study, the short hospital stay was maintained across the age groups, even in our octogenarian patients. This is of particular importance today because cost containment is increasingly required.

Some physicians who accept the benefits of CEA hesitate to recommend this operation for elderly patients in view of their limited life expectancy.\textsuperscript{30} This is not substantiated by many other studies showing that most octogenarians live long enough to benefit from CEA.\textsuperscript{11,16,17,20} In the study by Perler and Williams,\textsuperscript{10} the 5-year survival rate was 80% and the cumulative freedom from stroke was 80% at 10 years postoperatively.

**CONCLUSIONS**

Our analysis of a consecutive series of 293 CEAs demonstrates that, in our hands, this procedure can be performed in octogenarians with very little morbidity and mortality when performed under regional anesthesia with awake monitoring and with virtually an overnight hospital stay. Therefore, CEA should not be eliminated as a treatment option based on chronological age alone. To achieve such results in this group of very elderly patients, the surgeon should practice sound clinical judgment and careful preoperative evaluation in order to offer this operation selectively. It is also mandatory for all surgeons performing CEAs to be aware of their own results before applying the recommendations of clinical trials to their practice because those results can vary significantly among surgeons, especially at low-volume institutions.

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**REFERENCES**

That CEA is superior to medical therapy alone in the treatment of symptomatic and asymptomatic patients with severe carotid artery stenosis is well supported in the literature. The European Carotid Surgery Trial\(^1\) and the North American Symptomatic Carotid Endarterectomy Trial\(^2\) demonstrated the beneficial effects of surgical over medical treatment in patients with symptomatic carotid artery stenosis of more than 70%, and the Asymptomatic Carotid Atherosclerosis Study\(^3\) reached the same conclusion in patients with asymptomatic stenosis of more than 60%. Closer scrutiny of the data revealed a greater benefit in men vs women, younger vs older patients, and in patients with the worst vs least stenosis.\(^4\) None of these level 1 studies included octogenarians. Furthermore, hospitals and surgeons participating in the trials were carefully selected by the study organizers to include only centers of excellence. Thus, it is appropriate to examine the outcome of CEA performed in octogenarians in a community hospital setting.

Salaméh et al are the latest to review the results of CEA in octogenarians admitted to a single community hospital. Their rates of perioperative complications (cardiac, 1%; stroke, 1%) and death (0.7%) are similar to those in other reports.\(^5,6\) However, their patient management differed from that of other studies. Most of their patients (86.4%) were symptomatic. Many of the current series comprise an equal number of symptomatic and asymptomatic patients or slightly more asymptomatic patients.\(^5,7\) Salaméh et al relied on preoperative angiography in nearly two thirds of their patients, whereas many studies use carotid duplex scanning almost exclusively.\(^8,9\) Finally, the authors used electroencephalographic monitoring and locoregional anesthesia compared with others who used general anesthesia.\(^9\) Should octogenarians be treated differently? The life expectancy of an 80-year-old is 8.5 years and that of a 90-year-old is 4.6 years.\(^10\) I completely agree with the authors' conclusion that octogenarians can safely undergo CEA. They should not be excluded from this benefit based on age alone.

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