

generated a higher net revenue than symptomatic patients, whether undergoing CEA or CAS.

**Conclusions:** Hospital reimbursement for CAS was 18% higher than that for CEA. However, CEA was associated with a 33% higher net income because of the 40% cost premium of CAS. Asymptomatic patients have the lowest cost and highest net income of all the subgroups, likely due to less complex clinical presentation and associated testing. At present, CAS is not routinely cost-effective in a fee-for-service or capitated health care environment.

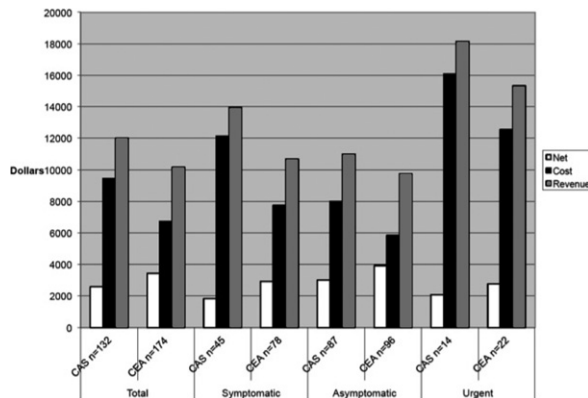


Fig.

**Surgical and Medical Management of Extracranial Carotid Artery Aneurysms**

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**Objectives:** Extracranial carotid artery aneurysms (ECCA) are extremely rare, with limited information regarding management options. Our purpose was to review our institution's experience with ECCA over 15 years.

**Methods:** A retrospective review of patients diagnosed with ECCA from 1998 to 2012 was performed. Symptoms, risk factors, etiology, diagnostic methods, treatments, and outcomes were reviewed.

**Results:** A total of 141 aneurysms were diagnosed in 132 patients (69 men; mean age, 61 years). There were 116 (82%) pseudoaneurysms and 25 (18%) true aneurysms: 114 (81%) aneurysms involved the internal carotid, 11 common (8%), 15 the bifurcation (10%), and one external (1%). A total of 69 aneurysms (49%) were asymptomatic and 72 (51%) had symptoms (28 painless mass, 10 TIAs, 10 vision symptoms, 9 ruptures, 8 strokes, 4 painful mass, 1 dysphagia, 1 tongue weakness, 1 bruit). Diagnosis was by MR in 61 (43%), CT in 40 (28%), ultrasound in 29 (21%), angiography in nine (6.5%), and after rupture in two (1.5%). Etiologies for true aneurysms included fibromuscular dysplasia in 15 patients, Ehlers Danlos in three, Marfan in one, and uncharacterized connective tissue diseases in two. A total of 11 of 25 true aneurysms (44%) were symptomatic, 15 (60%) true aneurysms underwent open surgical treatment, and 10 (40%) were managed nonoperatively. Surgical procedures included 14 (93%) aneurysmectomies with reconstruction (7 end-to-end, 4 saphenous interposition, 3 prosthetic interposition) and one (7%) aneurysmorrhaphy. Postoperative complications included one stroke during a mean follow-up of 31 months (range, 0-166 months). No aneurysms managed nonoperatively required intervention during a mean follow-up of 77 months (range, 1-115 months). Sixty of 116 pseudoaneurysms (52%) were symptomatic. Thirty-three pseudoaneurysms (29%) underwent open surgery, 18 (15%) underwent endovascular intervention, and 65 (56%) were managed medically. Pseudoaneurysm after endarterectomy (28 patients, 24%) presented at a mean of 82 months from the surgical procedure. Mean follow-up for all aneurysms was 33.9 months. One (0.7%) aneurysm-related death occurred (rupture treated palliatively). No patient undergoing nonoperative management died or suffered major morbidity related to the aneurysm. Nonoperative management was more common in asymptomatic patients (71%) than in symptomatic patients (31%).

**Conclusions:** ECCA are uncommon and may present with varying symptoms. All segments of the carotid artery are susceptible, although the internal is most commonly affected. Open surgical intervention was more common in patients with symptoms and with true aneurysms. Patients with

pseudoaneurysms were more likely to undergo endovascular intervention. Nonoperative treatment is safe in selected patients.

**Outcomes After Carotid Artery Surgery: Does Race Make a Difference?**

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**Objectives:** Carotid occlusive disease is a major cause of stroke, accounting for 20% to 25% of cases in the USA. Several studies have described a higher incidence of stroke and attributed mortality in minority ethnic groups. This study used a national database to identify ethnic disparity in terms of risk profile, clinical presentation, and outcome in patients undergoing carotid endarterectomy.

**Methods:** Using National Surgical Quality Improvement Program (NSQIP) data file from years 2005 to 2007, we identified patients undergoing carotid endarterectomy, CPT code (35301). Patients were divided into two groups based on ethnicity into white and nonwhite. Patient demographic, comorbidities, clinical presentation, postoperative morbidity, and mortality were compared between groups using  $\chi^2$  and *t* test as appropriate.

**Results:** Among 21,993 patients included in the study, 19,202 (87.3%) were white and 2791 (12.7%) were nonwhite. The minority nonwhite group was more likely to present with symptomatic carotid occlusive disease (7.5% vs 4.8%, *P* < .001), procedure was done emergently (2.3% vs 1.4%, *P* < .001), was younger (69.8 vs 71.7 years, *P* < .001), and had a higher proportion of women (43.5% vs 40.9%, *P* = .010). The nonwhite group also had significantly higher cardiovascular risk factors, including smoking, diabetes, coronary artery disease, history of coronary revascularization, chronic obstructive pulmonary disease, and end-stage renal disease (Table). Although there was no difference in postoperative myocardial infarction, stroke, patients with nonwhite ethnicity had higher overall postoperative morbidity (5.3% vs 4.0%, *P* = .001), mortality (1.2% vs 0.06, *P* = .001), and total hospital duration (3.3 ± 6.9 vs 2.3 ± 3.6 days, *P* < .001).

**Conclusions:** Review of the NSQIP database revealed ethnic minority patients presented with advance carotid occlusive disease at time of carotid surgery compared with white patients. This group also had higher postoperative morbidity and mortality and presented with higher number of cardiovascular risk factors. The findings may be due to delay in seeking treatment, limited access to care, and less rigorous screening. Further studies are required to identify factors delaying care for carotid occlusive disease in the nonwhite population.

Table.

| Variable                  | White          | Nonwhite     | P     |
|---------------------------|----------------|--------------|-------|
| Total                     | 19,202 (87.3%) | 2791 (12.7%) |       |
| Symptomatic disease       | 925 (4.8%)     | 208 (7.5%)   | <.001 |
| Emergency case            | 264 (1.4%)     | 64 (2.3%)    | <.001 |
| Female gender             | 7857 (86.6%)   | 1214 (13.4%) | 0.01  |
| Age, years                | 71.1 ± 9.3     | 69.8 ± 9.2   | <.001 |
| Hypertension              | 16,366 (85.2%) | 2399 (86.%)  | .330  |
| Myocardial infarction     | 269 (1.4%)     | 45 (1.6%)    | .395  |
| Acute CHF in 30 days      | 150 (0.8%)     | 30 (1.1%)    | .111  |
| COPD                      | 2078 (10.8%)   | 202 (7.2%)   | <.001 |
| IDDM                      | 1651 (8.6%)    | 349 (12.5%)  | <.001 |
| NIDDM                     | 3411 (17.8%)   | 632 (22.6%)  | <.001 |
| Smoker                    | 5296 (27.6%)   | 826 (29.6%)  | .028  |
| PCI                       | 3635 (18.9%)   | 462 (2.1%)   | .003  |
| CABG                      | 4485 (23.4%)   | 561 (20.1%)  | <.001 |
| ESRD                      | 152 (0.8%)     | 53 (1.9%)    | <.001 |
| ASA ≥3                    | 2381 (12.4%)   | 380 (13.6%)  | .070  |
| Postoperative variables   |                |              |       |
| Stroke/CVA                | 296 (1.5%)     | 41 (1.5%)    | .861  |
| Coma >24 hours            | 17 (0.1%)      | 6 (0.2%)     | .062  |
| MI                        | 120 (0.6%)     | 16 (0.6%)    | .885  |
| SSI                       | 42 (0.2%)      | 6 (0.2%)     | 1     |
| Sepsis                    | 85 (0.4%)      | 39 (1.4%)    | <.001 |
| Respiratory complications | 316 (1.6%)     | 78 (2.8%)    | <.001 |
| Renal complication        | 37 (0.2%)      | 10 (0.4%)    | .081  |
| Morbidity                 | 765 (4.0%)     | 148 (5.3%)   | .001  |
| Death                     | 124 (0.6%)     | 34 (1.2%)    | .001  |
| Length of surgery         | 114 ± 44       | 119 ± 46     | <.001 |
| Duration of hospital stay | 2.3 ± 3.6      | 3.3 ± 6.9    | <.001 |

ASA, American Society of Anesthesiologists; CABG, coronary artery bypass grafting; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; ESRD, end-stage renal disease; IDDM, insulin-dependent diabetes mellitus; MI, myocardial infarction; NIDDM, non-insulin-dependent diabetes mellitus; PCI, percutaneous coronary intervention.