

Scientific Session VI: Carotid**Clinician Volume and Outcomes for Carotid Artery Stenting (CAS): Is There Any Substitute for Experience with CAS?**

J. Gregory Modrall, Carlos H. Timaran, Jayer X. Chung, Melissa L. Kirkwood, M. Shadman Baig, Shirling X. Tsai, R. James Valentine, Eric B. Rosero. University of Texas Southwestern Medical Center, Dallas, Tex

Objectives: Prior studies demonstrated improved clinical outcomes for surgeons with a high volume experience with certain open vascular operations. It is not known whether a high volume experience with carotid artery stenting (CAS) improves clinical outcomes. Moreover, it is not known whether experience with other endovascular procedures, including percutaneous coronary interventions (PCI), is an adequate substitute for experience with CAS. Our objective was to assess the impact of increasing clinician volume of CAS, aortic endografting (EVAR/TEVAR), and PCI on the outcomes for CAS.

Methods: The Nationwide Inpatient Sample was analyzed to identify patients undergoing CAS for the years 2005-2009. Clinicians were stratified into tertiles of low-, medium-, and high-volume groups based on annual volume of CAS, EVAR/TEVAR, and PCI. Multiple logistic regression analyses were used to examine the relationship between clinician volume and a composite outcome of in-hospital stroke and death rate after CAS.

Results: Between 2005 and 2009, 83,072 elective CAS procedures were performed nationwide with crude in-hospital stroke and death rates of 1.94% and 1.12%, respectively. The median number of CAS procedures performed annually was seven per clinician (interquartile range, 2-17). Stroke and death rates for CAS decreased with increasing volume of CAS performed by a clinician (Table). Similar patterns were noted between clinicians' volume of EVAR/TEVAR and PCI and outcomes for CAS (Table). After adjusting for patient and hospital characteristics, however, clinician volume was not a significant predictor of outcomes for CAS, while symptomatic status was the dominant predictor of stroke and death after CAS (OR, 20.4; 95% CI, 15.3-27.3; $P < .0001$). For asymptomatic patients, clinician volume of CAS remained an independent predictor of stroke and death after CAS (OR, 0.79; 95% CI, 0.64-0.96, per 10 CAS cases; $P = .02$), whereas clinician volume of EVAR/TEVAR and PCI were not significant predictors of outcome for CAS.

Conclusions: When treating asymptomatic carotid stenosis, the stroke and death rate for CAS is 21% lower for every 10 CAS procedures performed by a clinician. Clinicians with wire and catheter skills should be advised that there is no substitute for experience with CAS to optimize outcomes of CAS performed in asymptomatic patients.

Table. Stroke and death rate for CAS stratified by tertiles of clinician volume

Tertiles of CAS volume	Stroke/death rate (%)
Tertile 1 (0-3 cases/y)	4.95%
Tertile 2 (3-13 cases/y)	2.11%
Tertile 3 (>13 cases/y)	1.79% ($P < .0001$) ^a
Tertiles of EVAR/TEVAR volume	Stroke/death rate (%)
Tertile 1 (0-4 cases/y)	3.28%
Tertile 2 (4-14.5 cases/y)	2.17%
Tertile 3 (>14.5 cases/y)	1.91% ($P = .037$) ^a
Tertiles of CAS volume	Stroke/death rate (%)
Tertile 1 (0-5.3 cases/y)	3.21%
Tertile 2 (5.3-375.7 cases/y)	2.92%
Tertile 3 (>375.7 cases/y)	2.19% ($P = .02$) ^a

^aCochran-Armitage Trend Test.

Long-Term Clinical Outcomes and Cardiovascular Events Following Carotid Endarterectomy

Efthymios Avgerinos, Rabih Chaer, Catherine Go, Joe Wazen, Jennifer Ling, Luke Marone, Larry Fish, Michel Makaroun. University of Pittsburgh, Pittsburgh, Pa

Objectives: Long-term atherosclerotic adverse events are anticipated in patients undergoing carotid endarterectomy (CEA); however, their incidence and risk predictors remain unknown.

Methods: A consecutive cohort of CEAs between January 1, 2000 and December 31, 2007 was analyzed. End points were any stroke, coronary event (myocardial infarction, coronary bypass, or stenting), vascular interventions for critical limb ischemia, aortic aneurysm or carotid disease, and death. Survival analysis and Cox regression models were used to identify clinical predictors.

Results: 1137 CEAs (bilateral 89, mean age 71.2 ± 9.2 years; 56.5% male; 36.3% symptomatic, 3.9% combined coronary artery bypass graft) were performed during the study period with a mean clinical follow-up of 60 months (0-155 months). Thirty-day stroke and death rates were 2.0% and 1.0%, respectively, stroke/death 2.7%. Freedom from a specific end point at 5 and 10 years was stroke 92.8% and 83.9%; coronary events 81.6% and 68.5%; and major vascular interventions 79.4% and 71.5%, respectively. Survival at 5 and 10 years was 74.2% and 49.9%. Statins conferred a significant protective effect for stroke (HR, 0.52; $P = .012$) and death (HR, 0.66; $P < .0001$). Pre-existing vascular disease predicted future vascular interventions (aortic aneurysm [HR, 1.89; $P = .001$]; peripheral arterial disease [HR, 1.96; $P < .0001$]; contralateral internal carotid artery stenosis >50% [HR, 4.42; $P < .0001$]). Renal insufficiency predicted worse outcomes for all end points (HR, 2.11; $P = .04$ for stroke; HR, 1.71; $P = .002$ for coronary events; HR, 2.3; $P < .0001$ for death) except for major vascular interventions.

Conclusions: Patients undergoing CEA benefit from low stroke rates but still sustain major coronary events and vascular interventions, indicating a need for more intensive medical treatment and rigorous follow-up.

Concurrent Carotid Endarterectomy and Coronary Artery Bypass Grafting / Valve Replacement in Asymptomatic Patients with Severe Carotid Stenosis: A Five Year Single Center Experience

Michael D. Lieb, Paul B. Haser, Saum A. Rahimi, Alan M. Graham. UNJ-RWJMS, New Brunswick, NJ

Objectives: The optimal management of patients who require coronary artery bypass grafting (CABG) or valve replacement that are found to have severe carotid stenosis (80%-99%) remains controversial. There are regional and institutional differences that determine whether these procedures will be staged or performed concurrently because of concerns over increased neurologic events, morbidity and/or mortality.

Methods: The charts of all patients undergoing combined carotid endarterectomy (CEA)/CABG or CEA/valve replacement from July 2007 to December 2012 at a single university hospital setting were reviewed. Demographic, stroke, death, operative times, and length of stay data were collected for all patients. Patients who required simultaneous CABG and valve replacement were not offered CEA. The 30-day stroke and mortality rates were calculated. For purposes of comparison, we also reviewed the patients with severe carotid stenosis undergoing CEA alone and patients undergoing CABG or valve replacement alone during the same time period.

Results: 117 patients (73 male, 44 female) with severe carotid stenosis undergoing combined procedures were identified (106 CEA/CABG, 11 CEA/valve replacement). The stroke rate was 1.7% at 30 days, and the mortality rate was 2.6%, with only one death associated with a late stroke, (postoperative day 59), for a combined stroke/death rate of 4.3%. There were no deaths in the CEA/valve replacement group. The stroke and death rate for the 582 CEA patients during the same time period was 0.5% with only two deaths during the 30-day time period. For patients undergoing CABG or valve replacement alone, the combined stroke/death rate was 3.5% in 2500 patients. The average operative time for all patients in the series was 6.3 hours, and of patients who suffered a postoperative stroke, the average operative time was 1.4 hours longer for the three mortalities. The majority of patients were discharged on postoperative day four vs 36 days for the two patients who suffered a stroke.

Conclusions: In patients with severe carotid stenosis and significant cardiac disease, combined surgery offers acceptable 30-day mortality and stroke rates and provides the benefit of only one anesthesia. Postoperative stroke increased length of stay. Mortality was associated with significantly increased operative times, however, operative times did not impact the rare occurrence of stroke in the series.

Repair of Large Internal Carotid Artery Aneurysm in a Patient with Neurofibromatosis Type 1

Saadat Shariff, Ashish Raju, Richard Smith, Michael Shih, Larry A. Scher, Evan C. Lipsitz. Montefiore Medical Center, Bronx, NY

Objectives: Neurofibromatosis type 1 is an autosomal dominant neurocutaneous disorder characterized by café au lait macules, neurofibromas and Lisch nodules and is rarely associated with cerebrovascular aneurysms. We describe a young male who presented with a 7-cm internal carotid artery (ICA) aneurysm and its repair.

Methods: The patient is a 24-year-old African American male with a history of neurofibromatosis type 1 and scoliosis repair who presented with a progressively enlarging right sided neck mass. There were no neurologic deficits, nor signs and symptoms of compression. Physical exam showed a large pulsatile right neck mass. A computed tomography scan and cervical angiogram demonstrated a 7.4-cm fusiform aneurysm of the right ICA (Fig). The saphenous veins were occluded bilaterally. Operative