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Carotid Artery Stenting and Carotid Endarterectomy

Stroke is the third leading cause of death and the leading cause of disability in the United States (1). Carotid occlusive disease accounts for roughly one third of strokes in this country. Surgical intervention with carotid endarterectomy (CEA) has been proven to reduce the incidence of stroke in both symptomatic and asymptomatic patients compared with medical therapy alone (2-4). Recently carotid artery stent implantation (CAS) has been proposed as an effective alternative to CEA for stroke prevention.

Carotid endarterectomy for the treatment of carotid occlusive disease was first performed in the 1950's. Randomized, controlled clinical trials demonstrating the procedure's efficacy were performed several decades later. The NASCET trial compared CEA to medical therapy in symptomatic patients and demonstrated a significant 17% absolute risk reduction for stroke at 2 years (2). The ACAS and ACST trials evaluated asymptomatic patients and demonstrated a significant, albeit less dramatic, absolute risk reduction for stroke (6.0%, 5.4%, respectively) (3, 4). These studies (and others) form the foundation for the current AHA/American Academy of Neurology recommendations that symptomatic patients with a $\geq 50\%$ stenosis should be considered for carotid revascularization if the peri-procedural risk of death or CVA is $\leq 6\%$. Asymptomatic patients with a $\geq 80\%$ stenosis should be considered for revascularization if the peri-procedural risk of death or CVA is $\leq 3\%$ (5, 6).

Patients in the NASCET, ACAS, and ACST trials were carefully selected and at low risk for surgical complication. Currently, many patients routinely undergoing CEA would have been excluded from those trials and such patients have significantly worse outcomes than reported in the trials (7). Carotid endarterectomy, like all invasive procedures, is not without complication. High volume centers performing CEA allow us to assess the risk and provide benchmarks with which to compare CAS (8). In addition, utilization of high volume centers avoids the inherent bias seen with individual operator reporting (9). Utilizing these data sets, factors which define a high surgical risk patient subset have been identified and can be divided into anatomic and co-morbid factors (10). Anatomic factors include contra-lateral occlusion, re-stenotic lesions, prior radiation, "hostile neck", high lesions requiring disarticulation of the mandible or low lesions below the clavicle requiring opening the chest cavity. Medical co-morbidities include CHF (class III or IV), asymptomatic left ventricular dysfunction, unstable angina, recent CABG, COPD, recent MI or age ≥ 80 years.

Over the past fifteen years, carotid angioplasty with stenting has been developed as an alternative to carotid endarterectomy. Initial efforts were limited by technical factors such as stent compression and plaque embolization to the brain (11-14). Nitinol alloy crush resistant stents and distal protection devices to prevent embolization have been developed (15). Initial studies have focused on patients at high risk for surgical complications who would have been excluded from the NASCET, ACAS, and ACST trials. In this patient subset, a randomized, controlled trial (16) has been published in a peer reviewed journal and unequivocally demonstrates that CAS is equivalent, i.e. non-inferior, to CEA (16). Three year follow up data have recently been published in a peer reviewed journal and demonstrate the durability of the outcomes with out a "tail-off" effect (17). Additional peer reviewed and published data sets include multiple pre-and post-market investigations required by the FDA and a large meta-analysis (18-30). A multi-specialty societal paper (10) reviewed the randomized controlled trial and additional peer-reviewed studies and found benefit with CAS in high surgical risk patient (both anatomic and co-morbid features) in symptomatic patients with $\geq 50\%$ stenosis and asymptomatic patients with $\geq 80\%$ stenosis. Based on many of these studies the FDA has approved devices for CAS. The Centers for Medicare and

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Medicaid Services (CMS) has indicated coverage for CAS in selected patient subsets and is currently reviewing additional data to consider expanding coverage. Following CMS and FDA approval, additional FDA mandated post-market approval studies have been performed. All have demonstrated acceptable results with CAS (31).

RANDOMIZED CONTROLLED TRIAL IN HIGH SURGICAL RISK PATIENTS

***SAPPHIRE** -The SAPPHIRE trial was a randomized, controlled trial comparing CEA with CAS in patients at high surgical risk (16). It initially included 747 patients who were either symptomatic with >50% ipsilateral stenosis or asymptomatic with a >80% ipsilateral stenosis; the majority were asymptomatic. A multi-disciplinary team of surgeons, neurologists and interventionalists confirmed the patient's eligibility. Vascular surgery declined 406 patients as not acceptable surgical candidates and therefore could not be randomized; interventionalists declined 7 patients. 334 were then randomized to either CEA or CAS and 310 were treated. 24 patients either withdrew consent, did not meet entry criteria or their condition deteriorated prior to their procedure. Thus 151 patients were randomized to CEA and 159 patients to CAS. The primary end point was death, stroke or myocardial infarction at 30 days or death or ipsilateral stroke between 31 days and 1 year. The primary endpoint occurred in 12.2% of CAS patients and 20.1% for CEA. This 7.9% absolute difference was significant (p=0.004) for non-inferiority.*

POST MARKET APPROVAL (PMA) STUDIES IN HIGH SURGICAL RISK PATIENTS

***EXACT** and **CAPTURE-2**- Both of these FDA mandated multi-center studies evaluated patients who were treated with newly approved devices by operators with varying levels of experience with CAS. Together these studies included over 6,000 patients and the results were published in a peer reviewed publication (31). All patients had independent neurological evaluation pre- and post procedure ensuring that all adverse neurologic events were captured. The overall combined 30 day death and stroke rate for the EXACT trial was 4.1% and 3.4% for CAPTURE-2. When looking at patients comparable to the 2006 AHA guidelines (< 80 years old) the combined 30 day risk of death and stroke was 5.3% in symptomatic patients ($\geq 50\%$ stenosis) and 2.9% for asymptomatic ($\geq 80\%$ stenosis) patients. Thus meeting or exceeding AHA recommendations of $\leq 6.0\%$ in symptomatic patients and $\leq 3\%$ in asymptomatic patients.*

SAPPHIRE WORLDWIDE REGISTRY IN HIGH SURGICAL RISK PATIENTS

The SAPPHIRE WW is post-market approval registry evaluating 30 day outcomes after CAS in high surgical risk patients performed by operators of varying experience at both academic and community hospitals. The first 2,001 patients were recently reported in a peer reviewed journal (32). All patients were judged high surgical risk and 27% were symptomatic. All had independent neurological evaluation pre- and post procedure ensuring that all adverse neurologic events were captured, similar to other studies. The overall combined 30 day risk of death or MI was 4.0%. Symptomatic patients had 30 day death and stroke rate of 4.5% and asymptomatic patients had a risk of 1.8%. Again meeting or exceeding AHA recommendations for revascularization.

ELDERLY PATIENTS AS CANDIDATES FOR CAS

Attention has focused on elderly patients (≥ 75 -80 years old) having an increased risk of invasive procedures- with both CEA (7, 33, 34) and CAS (22, 31, 35, 36). More recently three peer reviewed manuscripts have been published describing CAS with embolic protection in high surgical risk patients ≥ 80 years of age (37-39). The combined overall 30 day death and stroke rate was 3.3%, 2.7% and 0.8%. Other authors have emphasized the importance of patient selection and the avoidance of adverse features such as difficult aortic arch access, lesion tortuosity, and calcification which increase the risk of CAS. (36). Longer term follow up has indicated that, despite advanced

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age, the majority of patients survive at least three years and that 97% remain free of neurologic events (40). Currently the published, peer-reviewed literature does not support an age cut-off.

SOCIETAL STATEMENTS

Representatives from Cardiology (ACC and SCAI), Intervention Radiology (SIR), Vascular Medicine (SVM), and Neuroradiology (ASTIN) have co-authored a position paper endorsing the benefit of CAS in both symptomatic and asymptomatic high surgical risk patients (10). More recently the American Heart Association (AHA) sponsored a recently published symposium. The expert panel's writing committee consisted of representatives from Neurology, Radiology, Vascular Surgery, Vascular Medicine, and Cardiology (41, 42). They concluded:

For "patients with increased surgical risk for CEA due to unfavorable anatomic characteristics or medical co-morbidities, CAS offers an alternative treatment. Because it is a less invasive procedure, CAS should be considered an option for patients who are at increased risk for surgical complications of CEA". (41)

NON-HIGH SURGICAL RISK PATIENTS

Initial efforts at evaluating the safety of CAS and comparisons to CEA have focused on the high surgical risk patient population. Attention is now turning to the non-high surgical risk population, both symptomatic and asymptomatic. A randomized controlled clinical trial has been recently published in a peer reviewed journal indicating that in symptomatic, non-high surgical risk patients CAS is inferior to CEA (43). This trial has been criticized for the extreme inexperience of the interventionalists performing CAS and the notable experience of the operators performing CEA. Carotid stenting has a steep learning curve and some interventionalists in this trial had performed less than 5 procedures and were still being tutored at the time they began enrolling. A second study was stopped early due to funding constraints. Their outcomes were published and failed to prove non-inferiority between CAS and CEA however the results are inconclusive due to the failure to enroll the pre-determined sample size in order to draw statistically valid conclusions (44).

Current large scale randomized clinical trials such as CREST, TACIT (which includes a medical therapy arm), ACST -2 (international) and ACT-1 (asymptomatic patients only) are being conducted and their results in this important patient sub group are eagerly awaited. Until data comparing CEA to CAS in the non-high risk patients is reviewed and published in peer reviewed journals we cannot conclude that CAS is equivalent to CAS in this patient group and thus CEA remains the only proven intervention for stroke risk reduction.

Should non-high risk patients want carotid stenting as treatment for their disease they should be enrolled in one of the approved trials (but run the risk of being randomized to the CEA arm).

COST

Multiple studies have been undertaken to understand the financial implications of CAS and CEA. When looking at cost per quality-adjusted life year, CEA has been shown to be acceptable in younger patients, in patients with a low risk of peri-procedural stroke or in patients with a higher risk of stroke with medical therapy alone. This Markov decision analysis would be applicable to CAS as well (45). Direct comparisons of costs per admission between CEA and CAS are hampered by uncertainty of cost assumptions or heterogeneity in data but, in general, the two procedures are cost equivalent with CAS having greater direct costs associated with device acquisition but shorter lengths of stay and lower post procedure costs (46).

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SUMMARY

Controversies surrounding carotid artery intervention, both carotid stent implantation and carotid endarterectomy, remain. Carotid revascularization is frequent, with over 135,000 procedures performed annually, 90% of which are CEA. The vast majority (92%) of these patients are asymptomatic (47). Surgical revascularization has been proven to prevent stroke compared to medical therapy alone. In studies of more than 10,000 patients at high risk for surgical complications (both anatomic and co-morbid features) carotid artery stenting has been shown to be equivalent to CEA. In this patient population, CAS is an appropriate alternative to CEA (48).

There is minimal and less than robust data on non-high surgical risk patients at this time and these patients should still be considered for CEA. Studies in non-high surgical risk patients are underway and their results should shed light on this patient population. Until those studies are published, conclusions regarding CAS in the non-high surgical risk group cannot be made.

It is imprudent to consider abandoning CEA in favor of CAS, and would be foolhardy to ignore the wealth of data supporting CAS. It is not a question of superiority of either strategy. It requires a patient-specific approach based on safety; identifying which patients would be better candidates for stenting or better candidates for endarterectomy. Once the lowest risk procedure is identified this can be discussed with the patient and an informed decision made.

- **Patrick S. Coleman MD, FACC, FSCAI**

Bibliography

1. Heart Disease and Stroke Statistics-American Heart Association 2006 Update; *MMWR*, Vol 50, No7, Feb 2001.
2. North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effect of Carotid endarterectomy in symptomatic patients with high-grade stenosis. *N Engl J Med* 1991; 325: 445-453.
3. Executive Committee for the Asymptomatic Carotid Atherosclerosis Study. Endarterectomy for asymptomatic carotid artery stenosis. *JAMA* 1995; 273:1421-1428.
4. European Carotid Surgery Trialists' Collaborative Group, MRC European Carotid Surgery Trial: interim results for symptomatic patients with severe (70-99%) or with mild (0-29%) carotid stenosis. *Lancet* 2004; 363:1491-1502.
5. Sacco RL, Adams R, Albers G, et al. Guidelines for the Prevention of Stroke in Patients with Ischemic Stroke of Transient Ischemic Attack: A Statement for Healthcare Professionals From the American Heart Association/ American Council on Stroke: Co-sponsored by the Council of Cardiovascular Radiology and Intervention: The American Academy of Neurology affirms the value of this guideline. *Stroke* 2006; 37: 577-617.
6. Chaturvedi S, Bruno A, Feasby T, et al. Carotid endarterectomy- and evidence-based review: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. *Neurology* 2005; 65: 794-801.
7. Wennberg D, Lucas F, Birkmeyer J, et al. Variation in carotid endarterectomy mortality in the Medicare population. *JAMA* 1998; 279; 1278-81.
8. Ouriel K, Hertzner NR, Beven EG, et al. Preprocedural risk stratification: identifying an appropriate population for carotid stenting. *J Vasc Surg* 2001; 33: 728-732.
9. Rothwell PM, Slattery J, Warlow CP. A Systematic Review of the Risk of Stroke and Death due to Endarterectomy for Symptomatic Carotid Stenosis. *Stroke* 1996;27(2); 260-265.

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10. Bates, ER Babb JD, Casey DE, Jr., et al. ACCF/SCAI/SVMB/SIR/ASITN 2007 clinical expert consensus document on carotid stenting: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. *J Am Coll Cardiol* 2007; 49:126-70.
11. Yadav JS, Roubin GS, Iyer s, et al. Elective stenting of the extracranial carotid arteries. *Circulation* 1997; 95: 376-381.
12. Ohki T, Marin ML, Lyon RT, et al. Ex vivo human carotid artery bifurcation stenting: correlation of lesion characteristics with embolic potential. *J Vasc Surg* 1998; 27: 463-471.
13. Topol EJ, Yadav JS. Recognition of the importance of embolization in atherosclerotic vascular disease. *Circulation* 2000; 101:570-580.
14. Naylor AR, Bolia A, Abbott RJ, et al. Randomized study of carotid angioplasty and stenting versus carotid endarterectomy: a stopped trial. *J Vasc Surgery*; 1998:326-334.
15. Grube E, Gerckens U, Yeung AC, et al. Prevention of distal embolization during coronary angioplasty in saphenous vein grafts and native vessels using porous filter protection. *Circulation* 2001; 104:2436-2441.
16. Yadav JS, Wholey MH, Kuntz RE, et al. Protected carotid-artery stenting versus endarterectomy in high-risk patients. *N Engl J Med* 2004; 351:1493-1501.
17. Gurm HS, Yadav JS, Fayad P, et al. Long term results of carotid artery stenting versus endarterectomy in high-risk patients. *N Engl J Med* 2008; 358:1572-1579.
18. Gurm HS, Nallamothu BK, Yadav JS. Safety of carotid stenting for symptomatic carotid artery disease: a meta-analysis. *Eur Heart J* 2008; 29: 113-119.
19. Gray WA. Two-year composite endpoint results from the Archer Trials: Acculink for revascularization of carotids in high risk patients. *Am J Cardiol* 2004; 94:62E.
20. Gray WA, Hopkins LN, Yadav JS, et al. Protected carotid stenting in high-surgical-risk patients: the ARChER results. *J Vasc Surg* 2006; 44: 258-268.
21. Hopkins LN, Mayla S, Grube E, et al. Carotid artery revascularization in high surgical risk patients with the NexStent and the Filterwire EX/EZ: 1-year results in the CABERNET trail. *Catheter Cardiovasc Interv* 2008; 71: 950-960.
22. Iyer SS, White CJ, Hopkins LN, et al. Carotid artery revascularization in high-surgical-risk patients using the Carotid WALLSTENT and Filterwire EX/EZ: 1-year outcome in the BEACH Pivotal Group. *J Am Coll Cardiol* 2008; 51: 427-434.
23. Security: More good data for protected carotid stenting in high-risk surgical patients. 2003 (Accessed at http://www.medscape.com.viewarticle/461721_print.)
24. United States Food and Drug Administration, Center for Devices and Radiological Health: Abbott Xact Carotid Stent System, summary of the safety and effectiveness data. 2005. (Accessed at <http://www.fda.gov.cdrh/pdf4/p040038.html>.)
25. White CJ, for the Beach Investigators. BEACH Trial: 30 day outcomes of carotid wallstent and Filterwire EX/EZ distal protection system placement for treatment of high surgical risk patients. *J Am Coll Cardiol* 2005; 45:28A.
26. Safian RD, Bresnahan JF, Jaff MR, et al. Protected carotid stenting in high-risk patients with severe carotid artery stenosis. *J Am Coll Cardiol* 2006; 47: 2384-2389.
27. Gray WA, Jadav JS, Verta P, et al. The CAPTURE registry: results of carotid stenting with embolic protection in the post approval setting. *Catheter Cardiovasc Interv* 2007; 69:341-348.
28. Gray WA, Jadav JS, Verta P, et al. The CAPTURE registry: predictors of outcomes in carotid stenting with embolic protection for high surgical risk patients in the early post-approval setting. *Catheter Cardiovasc Interv* 2007; 70:1025-1033.
29. Katzen BT, Criado FJ, Ramee SR, et al. Carotid artery stenting with emboli protection surveillance study: thirty-day results of the CASES-PMS study. *Catheter Cardiovasc Interv* 2007; 70:316-323.
30. Ramee S, Higashida R. Evaluation of the Medtronic self-expanding carotid stent with distal protection in the treatment of carotid stenosis. (Abstract). *Am J Cardiol* 2004; 94:61E.

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31. Gray W, Chaturvedi S, Verta P. 30-Day outcomes for Carotid Artery Stenting in 6,320 patients from two prospective, multicenter high surgical risk registries. *Circ Cardiovascular Interment*; published on line Mar 6, 2009. DOI: 10.1161/CIRCINTERVENTIONS.108.823013.
32. Massop D, Dave R, Metzger C, et al. Stenting and Angioplasty with protection in patients at high-risk for endarterectomy: SAPHIRE Worldwide Registry first 2,001 patients. *Catheter Cardiovasc Interv* 2008; 73: 129-136.
33. Kazmers A, Perkins AJ, Huber TS, et al. Carotid surgery in octogenarians in Veterans Affairs medical centers. *J Surg Res* 1999; 81:87-90.
34. Miller MT, Comerota AJ, Tzilinis A, et al. Carotid endarterectomy in octogenarians: does increased age indicate "high risk?" *J Vasc Surg* 2005; 41: 231-237.
35. Hobson RW 2nd, Howard VJ, Roubin GS, et al. Carotid artery stenting is associated with increased complications in octogenarians; 30-day stroke and death rates in the CREST lead-in phase. *J Vasc Surg* 2004; 40:1106-1111.
36. Roubin GS, Iyer S, Halkin A, et al. Realizing the potential of carotid artery stenting: proposed paradigms for patient selection and procedural technique. *Circulation* 2006; 113: 2021-2030.
37. Chiam P, Roubin G, Iyer S, et al. Carotid artery stenting in elderly patients: Importance of case selection. *Catheter Cardiovasc Interv* 2008; 72:318-324.
38. Henry M, Henry I, Polydorou A, et al. Carotid angioplasty and stenting in octogenarians: is it safe? *Catheter Cardiovasc Interv* 2008; 72: 309-317.
39. Velez CA, White CJ, Reilly JP, et al. Carotid artery stent placement is safe in very elderly (≥ 80 years). *Catheter Cardiovasc Interv* 2008; 72: 303-308.
40. Chiam PT, Roubin GS, Panagopoulos G, et al. One-year clinical outcomes, midterm survival, and predictors of mortality after carotid stenting in elderly patients. *Circulation* 2009; 119: 2343-2348.
41. Creager MA, White CJ, Hiatt WR, et al. Atherosclerotic peripheral vascular disease symposium II: executive summary. *Circulation* 2008; 118: 2811-2825.
42. White CJ, Beckman JA, Cambria RP, et al. Atherosclerotic peripheral vascular disease symposium II: controversies in carotid stenting. *Circulation* 2008; 118: 2852-2859.
43. Mas JL, Chatelier G, Beyssen B, et al. Endarterectomy versus stenting in patients with symptomatic severe carotid stenosis. *N Engl J Med* 2006; 355:1660-1671.
44. The SPACE Collaborative Group, et al. 30 Day results from the SPACE trial of stent-protected angioplasty versus carotid endarterectomy in symptomatic patients: a randomized non-inferiority trial. *Lancet* 2006; 368: 1239-1247.
45. Cronenwett JL, Birkmeyer JD, Nackman GB, et al. Cost-effectiveness of carotid endarterectomy in asymptomatic patients. *J Vasc Surg* 1997; 25: 298-309.
46. Janssen MP, de Borst GJ, Mali WP, et al. Carotid stenting versus carotid endarterectomy: evidence basis and cost implications. *Eur J Vasc Endovasc Surg* 2008; 36: 258-264.
47. Timaran CH, Veith FJ, Rosero EB, et al. Intracranial hemorrhage after carotid endarterectomy and carotid stenting in the United States in 2005. *J Vasc Surg* 2009; 49: 623-628.
48. Ederle J, Featherstone RL, Brown MM. Randomized controlled trials comparing endarterectomy and endovascular treatment for carotid artery stenosis; A Cochrane Systematic Review. *Stroke* 2009; 40: 1373-1380.

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