

# Protocol

## Extracranial Carotid Artery Stenting

(70168)

(Formerly Extracranial Carotid Angioplasty/Stenting)

<b>Medical Benefit</b>		<b>Effective Date:</b> 10/01/12	<b>Next Review Date:</b> 05/18
<b>Preauthorization</b>	Yes	<b>Review Dates:</b> 01/08, 09/08, 09/09, 09/10, 09/11, 07/12, 05/13, 05/14, 05/15, 05/16, 05/17	

### **Preauthorization is required.**

*The following protocol contains medical necessity criteria that apply for this service. The criteria are also applicable to services provided in the local Medicare Advantage operating area for those members, unless separate Medicare Advantage criteria are indicated. If the criteria are not met, reimbursement will be denied and the patient cannot be billed. Please note that payment for covered services is subject to eligibility and the limitations noted in the patient's contract at the time the services are rendered.*

Populations	Interventions	Comparators	Outcomes
Individuals: <ul style="list-style-type: none"><li>• With carotid artery stenosis</li></ul>	Interventions of interest are: <ul style="list-style-type: none"><li>• Carotid artery stenting</li></ul>	Comparators of interest are: <ul style="list-style-type: none"><li>• Carotid endarterectomy</li></ul>	Relevant outcomes include: <ul style="list-style-type: none"><li>• Overall survival</li><li>• Morbid events</li><li>• Treatment-related mortality</li><li>• Treatment-related morbidity</li></ul>

### **Description**

Carotid artery angioplasty with stenting is a treatment for carotid stenosis that is intended to prevent future stroke. It is an alternative to medical therapy and a less-invasive alternative to carotid endarterectomy (CEA).

### **Summary of Evidence**

For individuals who have carotid artery stenosis who receive carotid artery stenting (CAS), the evidence includes randomized controlled trials (RCTs) and systematic reviews of RCTs. Relevant outcomes are overall survival, morbid events, and treatment-related mortality and morbidity. A substantial body of RCT evidence compares outcomes of CAS to CEA for symptomatic and asymptomatic patients with carotid stenosis. The evidence does not support use of CAS in carotid artery disease for the average-risk patient, because early adverse events are higher with CAS and long-term outcomes are no better. Data from RCTs and large database studies have established that the risk of CAS exceeds the threshold set to indicate overall benefit from the procedure. Therefore, for patients with carotid stenosis who are suitable candidates for CEA, CAS does not improve health outcomes. The evidence is sufficient to determine qualitatively that the technology is unlikely to improve the net health outcome.

### **Policy**

Carotid angioplasty with associated stenting and embolic protection may be considered **medically necessary** in patients with:

- 50–99% stenosis (North American Symptomatic Carotid Endarterectomy Trial [NASCET] measurement); AND
- symptoms of focal cerebral ischemia (transient ischemic attack or monocular blindness) in previous 120 days, symptom duration less than 24 hours, or nondisabling stroke; AND
- anatomic contraindication for carotid endarterectomy (such as prior radiation treatment or neck surgery, lesions surgically inaccessible, spinal immobility, or tracheostomy).

Carotid angioplasty with or without associated stenting and embolic protection is considered **investigational** for all other indications, including but not limited to, patients with carotid stenosis who are suitable candidates for carotid endarterectomy and patients with carotid artery dissection.

### Policy Guidelines

The intent of the policy statement is that carotid angioplasty with embolic protection but without stenting is investigational. There may be unique situations where the original intent of surgery was to perform carotid angioplasty with stenting and embolic protection but anatomic or other considerations prohibited placement of the stent.

### Medicare Advantage

For all indications coverage is limited to procedures performed using FDA-approved carotid artery stents and FDA-approved or -cleared embolic protection devices.

In addition CAS with embolic protection is reasonable and necessary only if performed in facilities that have been determined to be competent in performing the evaluation, procedure and follow-up necessary to ensure optimal patient outcomes (see Medicare Advantage Policy Guidelines).

For Medicare Advantage, PTA of the carotid artery concurrent with the placement of an FDA-approved carotid stent with embolic protection is considered **medically necessary** for the following:

- patients who are at high risk for CEA (see Medicare Advantage Policy Guidelines) and
- who also have symptomatic carotid artery stenosis greater than or equal to 70%.

All indications for PTA with or without stenting to treat obstructive lesions of the vertebral arteries remain **investigational**.

If deployment of the embolic protection device is not technically possible, and not performed, then the procedure is considered **investigational**.

All other indications for PTA without stenting are **investigational**.

For Medicare Advantage PTA of the carotid artery concurrent with the placement of an FDA-approved carotid stent with embolic protection is also considered **medically necessary** related to these Food and Drug Administration (FDA)-approved *Category B Investigational Device Exemption (IDE) Clinical Trials*:

- Patients who are at high risk for CEA and have symptomatic carotid artery stenosis between 50% and 70%, in accordance with the Category B IDE clinical trials regulation (42 CFR 405.201), as a routine cost of clinical trials, or in accordance with the NCD on carotid artery stenting (CAS) post-approval studies (Medicare NCD Manual 20.7);
- Patients who are at high risk for CEA and have asymptomatic carotid artery stenosis greater than or equal to 80%, in accordance with the Category B IDE clinical trials regulation (42 CFR 405.201), as a routine cost of clinical trials, or in accordance with the NCD on CAS post-approval studies (Medicare NCD Manual 20.7).

**Medicare Advantage Policy Guidelines**

Refer to the Endovascular Procedures for Intracranial Arterial Disease (Atherosclerosis and Aneurysms) Protocol for policy on cerebral arteries.

CAS with embolic protection is reasonable and necessary only if performed in Medicare approved facilities found at <https://www.cms.gov/Medicare/Medicare-General-Information/MedicareApprovedFacilitie/Carotid-Artery-Stenting-Facilities.html>.

Patients at high risk for CEA are defined as having significant comorbidities and/or anatomic risk factors (i.e., recurrent stenosis and/or previous radical neck dissection), and would be poor candidates for CEA. Significant comorbid conditions include but are not limited to:

- Congestive heart failure (CHF) class III/IV;
- Left ventricular ejection fraction (LVEF) less than 30%;
- Unstable angina;
- Contralateral carotid occlusion;
- Recent myocardial infarction (MI);
- Previous CEA with recurrent stenosis;
- Prior radiation treatment to the neck; and
- Other conditions that were used to determine patients at high risk for CEA in the prior carotid artery stenting trials and studies, such as ARCHER, CABERNET, SAPPHIRE, BEACH, and MAVERIC II.

Symptoms of carotid artery stenosis include carotid transient ischemic attack (distinct focal neurological dysfunction persisting less than 24 hours), focal cerebral ischemia producing a nondisabling stroke (modified Rankin scale less than three with symptoms for 24 hours or more), and transient monocular blindness (amaurosis fugax). Patients who have had a disabling stroke (modified Rankin scale greater than or equal to three) shall be excluded from coverage.

**Background**

Combined with optimal medical management, carotid angioplasty with or without stenting has been evaluated as an alternative to CEA. CAS involves the introduction of coaxial systems of catheters, microcatheters, balloons, and other devices. The procedure is most often performed through the femoral artery, but a transcervical approach can also be used to avoid traversing the aortic arch. The procedure typically takes 20 to 40 minutes. Interventionalists almost uniformly use an embolic protection device (EPD) designed to reduce the risk of stroke caused by thromboembolic material dislodged during CAS. EPDs can be deployed proximally (with flow reversal) or distally (using a filter). Carotid angioplasty rarely is performed without stent placement.

Proposed advantages of CAS over CEA include:

- General anesthesia is not used (although CEA can be performed under local/regional anesthesia)
- Cranial nerve palsies are infrequent sequelae (although almost all following CEA resolve over time)
- Simultaneous procedures may be performed on the coronary and carotid arteries.

## Regulatory Status

A number of carotid artery stents and embolic protection devices (EPDs) have been approved by the U.S. Food and Drug Administration (FDA) through the premarket approval process. Examples include:

Table 1. FDA-Approved Carotid Artery Stents and Embolic Protection Devices

Manufacturer	Stents and Devices	PMA/510(k) Date
Guidant, now Abbott Vascular	Acculink™ and RX Acculink™ carotid stents	Aug 2004
Guidant, now Abbott Vascular	Accunet™ and RX Accunet™ cerebral protection filters	Aug 2004
Abbott Vascular	Xact® RX carotid stent system	Sep 2005
Abbott Vascular	Emboshield® embolic protection system	Sep 2005
Cordis Corp.	Precise® nitinol carotid stent system	Sep 2006
Cordis Corp.	AngioGuard™ XP and RX emboli capture guidewire systems	Sep 2006
EndoTex Interventional Systems	NexStent® carotid stent over-the-wire and monorail delivery systems	Oct 2006
Boston Scientific	FilterWire EZ™ embolic protection system	Oct 2006
ev3, Arterial Evolution Technology	Protégé® Rx and SpideRx®	Jan 2007
Boston Scientific	Carotid Wallstent®	Oct 2008
GORE	GORE® Flow Reversal System	Feb 2009
GORE	GORE® Embolic Filter	May 2011
Medtronic/Invatec	Mo.Ma® Ultra Proximal Cerebral Protection Device	Oct 2009
Silk Road Medical	ENROUTE™ Transcarotid Stent System and ENROUTE Transcarotid Neuroprotection System	May 2015

FDA: Food and Drug Administration; PMA: premarket approval.

Each FDA-approved carotid stent is indicated for combined use with an EPD to reduce risk of stroke in patients considered to be at increased risk for periprocedural complications from CEA who are symptomatic with greater than 50% stenosis, or asymptomatic with greater than 80% stenosis—with degree of stenosis assessed by ultrasound or angiogram with computed tomography angiography also sometimes used. Patients are considered at increased risk for complications during CEA if affected by any item from a list of anatomic features and comorbid conditions included in each stent system's Information for Prescribers.

The RX Acculink™ Carotid Stent System is also approved for use in conventional risk patients (not considered at increased risk for complications during CEA) with symptoms and 70% or more stenosis by ultrasound or 50% or more stenosis by angiogram, and asymptomatic patients with 70% or more stenosis by ultrasound or 60% or more stenosis by angiogram.

FDA-approved stents and EPDs differ in the deployment methods used once they reach the target lesion, with the rapid exchange (RX) devices designed for more rapid stent and filter expansion. FDA has mandated post-marketing studies for EPDs, including longer follow-up for patients already reported to FDA and additional registry studies, primarily to compare outcomes as a function of clinician training and facility experience. Each manufacturer's system is available in various configurations (e.g., straight or tapered) and sizes (diameters and lengths) to match the vessel lumen that will receive the stent.

In February 2015, the Enroute™ Transcarotid NPS was cleared for marketing by FDA through the 510(k) process. The Enroute is a flow-reversal device designed to be placed via direct carotid access.

FDA product code: NIM (stents) and NTE (EPDs).

## Related Protocols

Endovascular Procedures for Intracranial Arterial Disease (Atherosclerosis and Aneurysms)

Endovascular Therapies for Extracranial Vertebral Artery Disease

Services that are the subject of a clinical trial do not meet our Technology Assessment Protocol criteria and are considered investigational. *For explanation of experimental and investigational, please refer to the Technology Assessment Protocol.*

It is expected that only appropriate and medically necessary services will be rendered. We reserve the right to conduct prepayment and postpayment reviews to assess the medical appropriateness of the above-referenced procedures. **Some of this protocol may not pertain to the patients you provide care to, as it may relate to products that are not available in your geographic area.**

## References

We are not responsible for the continuing viability of web site addresses that may be listed in any references below.

1. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis. North American Symptomatic Carotid Endarterectomy Trial Collaborators. *N Engl J Med.* Aug 15 1991; 325(7):445-453. PMID 1852179
2. MRC European Carotid Surgery Trial: interim results for symptomatic patients with severe (70-99%) or with mild (0-29%) carotid stenosis. European Carotid Surgery Trialists' Collaborative Group. *Lancet.* May 25, 1991; 337(8752):1235-1243. PMID 1674060
3. Mayberg MR, Wilson SE, Yatsu F, et al. Carotid endarterectomy and prevention of cerebral ischemia in symptomatic carotid stenosis. Veterans Affairs Cooperative Studies Program 309 Trialist Group. *JAMA.* Dec 18 1991; 266(23):3289-3294. PMID 1960828
4. Endarterectomy for asymptomatic carotid artery stenosis. Executive Committee for the Asymptomatic Carotid Atherosclerosis Study. *JAMA.* May 10, 1995; 273(18):1421-1428. PMID 7723155
5. Randomised trial of endarterectomy for recently symptomatic carotid stenosis: final results of the MRC European Carotid Surgery Trial (ECST). *Lancet.* May 9, 1998; 351(9113):1379-1387. PMID 9593407
6. Barnett HJ, Taylor DW, Eliasziw M, et al. Benefit of carotid endarterectomy in patients with symptomatic moderate or severe stenosis. North American Symptomatic Carotid Endarterectomy Trial Collaborators. *N Engl J Med.* Nov 12 1998; 339(20):1415-1425. PMID 9811916
7. Halliday A, Mansfield A, Marro J, et al. Prevention of disabling and fatal strokes by successful carotid endarterectomy in patients without recent neurological symptoms: randomised controlled trial. *Lancet.* May 8, 2004; 363(9420):1491-1502. PMID 15135594
8. Arazi HC, Capparelli FJ, Linetzky B, et al. Carotid endarterectomy in asymptomatic carotid stenosis: a decision analysis. *Clin Neurol Neurosurg.* May 2008; 110(5):472-479. PMID 18374476
9. Marquardt L, Geraghty OC, Mehta Z, et al. Low risk of ipsilateral stroke in patients with asymptomatic carotid stenosis on best medical treatment: a prospective, population-based study. *Stroke.* Jan 2010; 41(1):e11-17. PMID 19926843
10. Naylor AR, Bell PR. Treatment of asymptomatic carotid disease with stenting: con. *Semin Vasc Surg.* Jun 2008; 21(2):100-107. PMID 18565417
11. Brott TG, Hobson RW, 2nd, Howard G, et al. Stenting versus endarterectomy for treatment of carotid-artery stenosis. *N Engl J Med.* Jul 1 2010; 363(1):11-23. PMID 20505173
12. De Rango P, Brown MM, Leys D, et al. Management of carotid stenosis in women: consensus document. *Neurology.* Jun 11 2013; 80(24):2258-2268. PMID 23751919

13. Jordan WD, Jr., Voellinger DC, Fisher WS, et al. A comparison of carotid angioplasty with stenting versus endarterectomy with regional anesthesia. *J Vasc Surg.* Sep 1998; 28(3):397-402; discussion 402-393. PMID 9737448
14. Lewis SC, Warlow CP, Bodenham AR, et al. General anaesthesia versus local anaesthesia for carotid surgery (GALA): a multicentre, randomised controlled trial. *Lancet.* Dec 20 2008; 372(9656):2132-2142. PMID 19041130
15. Yadav JS, Wholey MH, Kuntz RE, et al. Protected carotid-artery stenting versus endarterectomy in high-risk patients. *N Engl J Med.* Oct 7 2004; 351(15):1493-1501. PMID 15470212
16. Gurm HS, Yadav JS, Fayad P, et al. Long-term results of carotid stenting versus endarterectomy in high-risk patients. *N Engl J Med.* Apr 10 2008; 358(15):1572-1579. PMID 18403765
17. Eckstein HH, Ringleb P, Allenberg JR, et al. Results of the Stent-Protected Angioplasty versus Carotid Endarterectomy (SPACE) study to treat symptomatic stenoses at 2 years: a multinational, prospective, randomised trial. *Lancet Neurol.* Oct 2008; 7(10):893-902. PMID 18774746
18. Ringleb PA, Allenberg J, Bruckmann H, et al. 30 day results from the SPACE trial of stent-protected angioplasty versus carotid endarterectomy in symptomatic patients: a randomised non-inferiority trial. *Lancet.* Oct 7 2006; 368(9543):1239-1247. PMID 17027729
19. Naylor AR. SPACE: not the final frontier [Comment]. *Lancet.* Oct 7 2006; 368(9543):1215-1216. PMID 17027708
20. Furlan AJ. Carotid-artery stenting--case open or closed? [Editorial]. *N Engl J Med.* Oct 19 2006; 355(16):1726-1729. PMID 17050898
21. Mas JL, Chatellier G, Beyssen B, et al. Endarterectomy versus stenting in patients with symptomatic severe carotid stenosis. *N Engl J Med.* Oct 19 2006; 355(16):1660-1671. PMID 17050890
22. Arquizan C, Trinquart L, Touboul PJ, et al. Restenosis is more frequent after carotid stenting than after endarterectomy: the EVA-3S study. *Stroke.* Apr 2011; 42(4):1015-1020. PMID 21311065
23. Mas JL, Trinquart L, Leys D, et al. Endarterectomy Versus Angioplasty in Patients with Symptomatic Severe Carotid Stenosis (EVA-3S) trial: results up to 4 years from a randomised, multicentre trial. *Lancet Neurol.* Oct 2008; 7(10):885-892. PMID 18774745
24. Mas JL, Arquizan C, Calvet D, et al. Long-term follow-up study of endarterectomy versus angioplasty in patients with symptomatic severe carotid stenosis trial. *Stroke.* Sep 2014; 45(9):2750-2756. PMID 25082808
25. International Carotid Stenting Study Investigators, Ederle J, Dobson J, et al. Carotid artery stenting compared with endarterectomy in patients with symptomatic carotid stenosis (International Carotid Stenting Study): an interim analysis of a randomised controlled trial. *Lancet.* Mar 20 2010; 375(9719):985-997. PMID 20189239
26. Bonati LH, Jongen LM, Haller S, et al. New ischaemic brain lesions on MRI after stenting or endarterectomy for symptomatic carotid stenosis: a substudy of the International Carotid Stenting Study (ICSS). *Lancet Neurol.* Apr 2010; 9(4):353-362. PMID 20189458
27. Rothwell PM. Carotid stenting: more risky than endarterectomy and often no better than medical treatment alone [Comment]. *Lancet.* Mar 20 2010; 375(9719):957-959. PMID 20304225
28. Bonati LH, Dobson J, Featherstone RL, et al. Long-term outcomes after stenting versus endarterectomy for treatment of symptomatic carotid stenosis: the International Carotid Stenting Study (ICSS) randomised trial. *Lancet.* Feb 7 2015; 385(9967):529-538. PMID 25453443
29. Altinbas A, Algra A, Brown MM, et al. Effects of carotid endarterectomy or stenting on hemodynamic complications in the International Carotid Stenting Study: a randomized comparison. *Int J Stroke.* Apr 2014; 9(3):284-290. PMID 23834300
30. Featherstone RL, Dobson J, Ederle J, et al. Carotid artery stenting compared with endarterectomy in patients with symptomatic carotid stenosis (International Carotid Stenting Study): a randomised controlled trial with cost-effectiveness analysis. *Health Technol Assess.* Mar 2016; 20(20):1-94. PMID 26979174



31. Hopkins LN, Roubin GS, Chakhtoura EY, et al. The Carotid Revascularization Endarterectomy versus Stenting Trial: credentialing of interventionalists and final results of lead-in phase. *J Stroke Cerebrovasc Dis.* Mar 2010; 19(2):153-162. PMID 20189092
32. Silver FL, Mackey A, Clark WM, et al. Safety of stenting and endarterectomy by symptomatic status in the Carotid Revascularization Endarterectomy Versus Stenting Trial (CREST). *Stroke.* Mar 2011; 42(3):675-680. PMID 21307169
33. Lal BK, Beach KW, Roubin GS, et al. Restenosis after carotid artery stenting and endarterectomy: a secondary analysis of CREST, a randomised controlled trial. *Lancet Neurol.* Sep 2012; 11(9):755-763. PMID 22857850
34. Brott TG, Howard G, Roubin GS, et al. Long-term results of stenting versus endarterectomy for carotid-artery stenosis. *N Engl J Med.* Mar 17 2016; 374(11):1021-1031. PMID 26890472
35. Roffi M, Sievert H, Gray WA, et al. Carotid artery stenting versus surgery: adequate comparisons? *Lancet Neurol.* Apr 2010; 9(4):339-341; author reply 341-332. PMID 20189459
36. Nallamothu BK, Gurm HS, Ting HH, et al. Operator experience and carotid stenting outcomes in Medicare beneficiaries. *JAMA.* Sep 28 2011; 306(12):1338-1343. PMID 21954477
37. Gonzales NR, Demaerschalk BM, Voeks JH, et al. Complication rates and center enrollment volume in the carotid revascularization endarterectomy versus stenting trial. *Stroke.* Nov 2014; 45(11):3320-3324. PMID 25256180
38. Rosenfield K, Matsumura JS, Chaturvedi S, et al. Randomized trial of stent versus surgery for asymptomatic carotid stenosis. *N Engl J Med.* Mar 17 2016; 374(11):1011-1020. PMID 26886419
39. Spence JD, Naylor AR. Endarterectomy, stenting, or neither for asymptomatic carotid-artery stenosis [editorial]. *N Engl J Med.* Mar 17 2016; 374(11):1087-1088. PMID 26890473
40. Li FM, Zhong JX, Jiang X, et al. Therapeutic effect of carotid artery stenting versus endarterectomy for patients with high-risk carotid stenosis. *Int J Clin Exp Med.* 2014; 7(9):2895-2900. PMID 25356155
41. Kuliha M, Roubec M, Prochazka V, et al. Randomized clinical trial comparing neurological outcomes after carotid endarterectomy or stenting. *Br J Surg.* Feb 2015; 102(3):194-201. PMID 25511816
42. Gray WA. Carotid stenting or carotid surgery in average surgical-risk patients: interpreting the conflicting clinical trial data. *Prog Cardiovasc Dis.* Jul-Aug 2011; 54(1):14-21. PMID 21722782
43. Woo K, Garg J, Hye RJ, et al. Contemporary results of carotid endarterectomy for asymptomatic carotid stenosis. *Stroke.* May 2010; 41(5):975-979. PMID 20339122
44. Barnett HJ, Pelz DM, Lownie SP. Reflections by contrarians on the post-CREST evaluation of carotid stenting for stroke prevention. *Int J Stroke.* Dec 2010; 5(6):455-456. PMID 21050401
45. Angioplasty and stenting of the cervical carotid artery with distal embolic protection of the cerebral circulation. *Technol Eval Cent Assess Program Exec Summ.* Feb 2005; 19(15):1-4. PMID 15714698
46. Ederle J, Featherstone RL, Brown MM. Randomized controlled trials comparing endarterectomy and endovascular treatment for carotid artery stenosis: a Cochrane systematic review. *Stroke.* Apr 2009; 40(4):1373-1380. PMID 19228850
47. Bangalore S, Kumar S, Wetterslev J, et al. Carotid artery stenting vs. carotid endarterectomy: meta-analysis and diversity-adjusted trial sequential analysis of randomized trials. *Arch Neurol.* Feb 2011; 68(2):172-184. PMID
48. Murad MH, Shahrour A, Shah ND, et al. A systematic review and meta-analysis of randomized trials of carotid endarterectomy vs. stenting. *J Vasc Surg.* Mar 2011; 53(3):792-797. PMID 21216556
49. Economopoulos KP, Sergentanis TN, Tsvigoulis G, et al. Carotid artery stenting versus carotid endarterectomy: a comprehensive meta-analysis of short-term and long-term outcomes. *Stroke.* Mar 2011; 42(3):687-692. PMID 21233476
50. Touze E, Trinquart L, Chatellier G, et al. Systematic review of the perioperative risks of stroke or death after carotid angioplasty and stenting. *Stroke.* Dec 2009; 40(12):e683-693. PMID 19892997
51. Carotid Stenting Trialists C, Bonati LH, Dobson J, et al. Short-term outcome after stenting versus endarterectomy for symptomatic carotid stenosis: a preplanned meta-analysis of individual patient data. *Lancet.* Sep 25 2010; 376(9746):1062-1073. PMID 20832852

52. Howard G, Roubin GS, Jansen O, et al. Association between age and risk of stroke or death from carotid endarterectomy and carotid stenting: a meta-analysis of pooled patient data from four randomised trials. *Lancet*. Mar 26 2016; 387(10025):1305-1311. PMID 26880122
53. Paraskevas KI, Lazaridis C, Andrews CM, et al. Comparison of cognitive function after carotid artery stenting versus carotid endarterectomy. *Eur J Vasc Endovasc Surg*. Mar 2014; 47(3):221-231. PMID 24393665
54. Galyfos G, Sigala F, Karanikola E, et al. Cardiac damage after carotid intervention: a meta-analysis after a decade of randomized trials. *J Anesth*. Dec 2014; 28(6):866-872. PMID 24828849
55. Vincent S, Eberg M, Eisenberg MJ, et al. Meta-analysis of randomized controlled trials comparing the long-term outcomes of carotid artery stenting versus endarterectomy. *Circ Cardiovasc Qual Outcomes*. Oct 2015; 8(6 Suppl 3):S99-108. PMID 26515216
56. Blue Cross and Blue Shield Association, Technology Evaluation Center. Angioplasty and stenting of the cervical carotid artery with embolic protection of the cerebral circulation. *TEC Assessment*. 2010; Volume 24: Tab 12. PMID 21114063
57. Gray WA, Chaturvedi S, Verta P, et al. Thirty-day outcomes for carotid artery stenting in 6320 patients from 2 prospective, multicenter, high-surgical-risk registries. *Circ Cardiovasc Interv*. Jun 2009; 2(3):159-166. PMID 20031712
58. White CJ, Iyer SS, Hopkins LN, et al. Carotid stenting with distal protection in high surgical risk patients: the BEACH trial 30 day results. *Catheter Cardiovasc Interv*. Apr 2006; 67(4):503-512. PMID 16548004
59. Spangler EL, Goodney PP, Schanzer A, et al. Outcomes of carotid endarterectomy versus stenting in comparable medical risk patients. *J Vasc Surg*. Nov 2014; 60(5):1227-1231, 1231 e1221. PMID 24953899
60. Lee VH, Brown RD, Jr., Mandrekar JN, et al. Incidence and outcome of cervical artery dissection: a population-based study. *Neurology*. Nov 28 2006; 67(10):1809-1812. PMID 17130413
61. Schirmer CM, Atalay B, Malek AM. Endovascular recanalization of symptomatic flow-limiting cervical carotid dissection in an isolated hemisphere. *Neurosurg Focus*. Jun 2011; 30(6):E16. PMID 21631217
62. Ohta H, Natarajan SK, Hauck EF, et al. Endovascular stent therapy for extracranial and intracranial carotid artery dissection: single-center experience. *J Neurosurg*. Jul 2011; 115(1):91-100. PMID 21417710
63. Asif KS, Lazzaro MA, Teleb MS, et al. Endovascular reconstruction for progressively worsening carotid artery dissection. *J Neurointerv Surg*. Jan 2015; 7(1):32-39. PMID 24391159
64. Brott TG, Halperin JL, Abbara S, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS Guideline on the Management of Patients With Extracranial Carotid and Vertebral Artery Disease A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American Stroke Association, American Association of Neuroscience Nurses, American Association of Neurological Surgeons, American College of Radiology, American Society of Neuroradiology, Congress of Neurological Surgeons, Society of Atherosclerosis Imaging and Prevention, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of NeuroInterventional Surgery, Society for Vascular Medicine, and Society for Vascular Surgery Developed in Collaboration With the American Academy of Neurology and Society of Cardiovascular Computed Tomography. *J Am Coll Cardiol*. Feb 22 2011; 57(8):e16-94. PMID 21288679
65. Brott TG, Halperin JL, Abbara S, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease. A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American Stroke Association, American Association of Neuroscience Nurses, American Association of Neurological Surgeons, American College of Radiology, American Society of Neuroradiology, Congress of Neurological Surgeons, Society of Atherosclerosis Imaging and Prevention, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of NeuroInterventional Surgery, Society for Vascular Medicine, and Society for Vascular Surgery. *Circulation*. Jul 26 2011; 124(4):e54-130. PMID 21282504



66. Brott TG, Halperin JL, Abbara S, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease: executive summary. *Stroke*. Aug 2011; 42(8):e420-463. PMID 21282494
67. Ricotta JJ, Aburahma A, Ascher E, et al. Updated Society for Vascular Surgery guidelines for management of extracranial carotid disease. *J Vasc Surg*. Sep 2011; 54(3):e1-31. PMID 21889701
68. Tendera M, Aboyans V, Bartelink ML, et al. ESC Guidelines on the diagnosis and treatment of peripheral artery diseases: Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries: the Task Force on the Diagnosis and Treatment of Peripheral Artery Diseases of the European Society of Cardiology (ESC). *Eur Heart J*. Nov 2011; 32(22):2851-2906. PMID 21873417
69. National Institute for Health and Clinical Excellence (NICE). Carotid artery stent placement for asymptomatic carotid artery stenosis [IPG388]. 2011; <https://www.nice.org.uk/guidance/ipg388>. Accessed April 21, 2017.
70. Carotid Stenting Guidelines Committee: an Inter-collegiate Committee of the RACP (ANZAN C, RACS (ANZSVS), RANZCR. Guidelines for patient selection and performance of carotid artery stenting. *Intern Med J*. Apr 2011; 41(4):344-347. PMID 21299785
71. Hopkins LN, Myla 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 trial. *Catheter Cardiovasc Interv*. Jun 1 2008; 71(7):950-960. PMID 18412236