

Invasive treatment of asymptomatic extracranial carotid stenosis. A conceptual approach

*Tratamento invasivo da estenose assintomática da carótida extracraniana.
Uma abordagem conceitual*

Ricardo Cesar Rocha Moreira¹

In the second decade of the XXI century, a vast body of knowledge (>4,800 articles listed in Medline) has been accumulated on all aspects of extracranial carotid disease. Out of this wealth of information, scientific Societies all over the world have proposed guidelines for the management of cerebrovascular disease.¹⁻⁴

Current guidelines have reached nearly a consensus on the role of invasive treatment in symptomatic patients with extracranial carotid stenosis.⁵ However, in asymptomatic patients, there is much uncertainty as to whether invasive treatments - carotid endarterectomy (CEA) and carotid angioplasty with stenting (CAS) - reduce stroke risk. The benefit of adding an invasive treatment to Best Medical Therapy (BMT) is currently the most controversial issue in the management of patients with asymptomatic extracranial carotid stenosis.⁶

The author proposes an alternate approach to the issue of which patients with asymptomatic carotid disease can benefit from invasive treatment. The knowledge accumulated in over a century of studies can be summarized in a few concepts, from which a framework can be formed.⁷ The conceptual framework can be used as a provisional tool to make clinical decisions, when guidelines are not clear or applicable to an individual patient.

The first concept can be stated as follows: “the vast majority of individuals with extracranial carotid lesions are asymptomatic and will remain asymptomatic for life.” This concept is based on over 50 long-term prospective studies that followed patients with carotid plaques on medical treatment.^{5,8} Those studies have shown that patients with asymptomatic carotid atherosclerosis have a much higher risk of ischemic cardiac events and long-term mortality, compared with the population at large.⁸ This concept leads to two corollaries: the presence of an asymptomatic carotid plaque is a strong marker of systemic atherosclerosis; and all patients in whom a carotid plaque is detected

should be placed on BTM and followed closely for progression of their atherosclerotic disease.^{3,4,8}

The second concept refers to risk: “Patients with asymptomatic carotid atherosclerosis on BMT have a low risk of developing an ischemic cerebral vascular accident (CVA).” A recent meta-analysis of 49 long-term studies showed that the overall risk of ischemic brain events in patients on medical management is below 1% per year of follow-up.⁹ Nevertheless, a minority of patients with asymptomatic carotid lesions will develop brain ischemia. The quest for physicians involved in care of patients with asymptomatic carotid atherosclerosis is finding which patients are at higher-than-average risk of developing brain ischemic events.⁴⁻⁶

The third concept refers to benefit: “The benefit of invasive treatment of asymptomatic extracranial carotid atherosclerosis is limited to a subgroup of patients with high-risk lesions.” Namely, vulnerable carotid plaques. The characteristics that define a vulnerable plaque include: a large lipid-laden core, a thin fibrous cap, inflammation in and/or around the plaque, vasavosorum neovascularization, and intraplaque hemorrhage.¹⁰ Vulnerable plaques are particularly prone to develop plaque events. The most common events: plaque ulceration, intraplaque hemorrhage and plaque rupture result in extrusion of atheromatous contents into the arterial lumen, causing embolization to the distal arterial bed. Distal embolization from events within a carotid plaque is the main mechanism of brain ischemia, and can present clinically as transient ischemic attack (TIA) and ischemic cerebral vascular accident (CVA).^{4,10} The other mechanism of brain ischemia related to the plaque is internal carotid artery occlusion, that can be caused by an plaque event such as hemorrhage or by progression of a plaque to high-degree or subocclusive stenosis, with subsequent thrombosis.¹⁰

A number of studies have been conducted in asymptomatic carotid patients on BMT in order to

¹Hospital Nossa Senhora das Graças, Serviço de Cirurgia Vascular, Curitiba, PR, Brasil.
Financial support: None.

Conflicts of interest: No conflicts of interest declared concerning the publication of this article.
Submitted: December 30, 2017. Accepted: January 2, 2018.

identify factors that increase the risk of a cerebral ischemic event.^{4,11} In those studies, the following clinical or imaging factors have been found to be associated with statistically significant increased risk of late stroke in asymptomatic patients with a 60-99% extracranial carotid stenosis:

- Silent brain infarction on CT scan;
- Progression of degree of stenosis on serial Doppler ultrasonography exams;
- Plaque area in computerized plaque analysis: the larger the plaque, the larger the risk;
- Size of juxta-luminal hypoechoic (or echolucent) area within the carotid plaque;
- Intraplaque hemorrhage on MR imaging;
- Impaired CVR - cerebral vascular reserve - on transcranial ecodoppler;
- Predominantly echolucent plaque on Doppler ultrasonography;
- Spontaneous embolization on transcranial ecodoppler;
- Spontaneous embolization on transcranial ecodoppler, plus echolucent plaque;
- Contralateral carotid occlusion or contralateral clinical cerebral ischemia (TIA or CVA).

Over the next 5 to 10 years, the ongoing prospective studies will provide hard data on the significance of those clinical and imaging risk factors and will probably change current recommendations on the invasive treatment of asymptomatic extracranial carotid stenosis.¹² While this new information is not available, the question “Which patients can benefit of invasive treatment for asymptomatic extracranial carotid stenosis ?” can be answered using the conceptual framework presented above:

1. A carotid atherosclerotic plaque is a strong marker of systemic atherosclerosis. All patients with a significant plaque should be on BMT and followed closely for cardiovascular ischemic events;
2. Invasive treatments - CEA or CAS - should be offered only to asymptomatic patients on BMT whose plaques present with or progress to high-degree/subocclusive stenosis; and to patients in whom clinical or imaging evaluation suggests a vulnerable plaque with high-risk of triggering cerebral ischemia.

REFERENCES

1. 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. 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 of Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of NeuroInterventional Surgery, Society for Vascular Medicine, and Society for Vascular Surgery. *Circulation*. 2011;124(4):54-130. <http://dx.doi.org/10.1161/CIR.0b013e31820d8d78>. PMID: 21282505.
2. Ricotta JJ, Aburahma A, Ascher E, Eskandari M, Faries P, Lal BK. Updated Society for Vascular Surgery guidelines for management of extracranial carotid disease. *J Vasc Surg*. 2011;54(3):e1-31. <http://dx.doi.org/10.1016/j.jvs.2011.07.031>. PMID:21498023.
3. 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*. 2011;32(22):2851-906. <http://dx.doi.org/10.1093/eurheartj/ehr211>. PMID:21873417.
4. Naylor AR, Ricco JB, Borst GJ, et al. Editor's Choice - Management of Atherosclerotic Carotid and Vertebral Artery Disease: 2017 Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS). *Eur J Vasc Endovasc Surg*. 2018;55(1):3-81. <http://dx.doi.org/10.1016/j.ejvs.2017.06.021>. PMID: 28851594.
5. Abbott AL, Paraskevas KI, Kakkos S, et al. Systematic Review of Guidelines for the Management of Asymptomatic and Symptomatic Carotid Stenosis. *Stroke*. 2015;46(11):3288-301. <http://dx.doi.org/10.1161/STROKEAHA.115.003390>. PMID:26451020.
6. Naylor AR. Why is the management of asymptomatic carotid disease so controversial? *Surgeon*. 2015;13(1):34-43. <http://dx.doi.org/10.1016/j.surge.2014.08.004>. PMID:25439170.
7. Ravitch SM, Riggan M. Reason & Rigor. how conceptual frameworks guide research. 2nd ed. Thousand Oaks CA: Sage Publications, 2017.
8. Giannopoulos A, Kakkos S, Abbott A, et al. Long-term mortality in patients with asymptomatic carotid stenosis: implications for statin therapy. *Eur J Vasc Endovasc Surg*. 2015;50(5):573-82. <http://dx.doi.org/10.1016/j.ejvs.2015.06.115>. PMID:26299982.
9. Hadar N, Raman G, Moorthy D, et al. Asymptomatic carotid artery stenosis treated with medical therapy alone: temporal trends and implications for risk assessment and the design of future studies. *Cerebrovasc Dis*. 2014;38(3):163-73. <http://dx.doi.org/10.1159/000365206>. PMID:25300534.
10. Naim C, Douziech M, Therasse E, et al. Vulnerable atherosclerotic carotid plaque evaluation by ultrasound, computed tomography angiography, and magnetic resonance imaging: an overview. *Can Assoc Radiol J*. 2014;65(3):275-86. <http://dx.doi.org/10.1016/j.carj.2013.05.003>. PMID:24360724.
11. Nicolaidis AN, Kakkos SK, Kyriacou E, et al. Asymptomatic internal carotid artery stenosis and cerebrovascular risk stratification. *J Vasc Surg*. 2010;52(6):1486-96. 5. <http://dx.doi.org/10.1016/j.jvs.2010.07.021>. PMID:21146746.

12. Rubin MN, Barrett KM, Brott TG, Meschia JF. Asymptomatic carotid stenosis: what we can learn from the next generation of randomized clinical trials. *JRSM Cardiovasc Dis.* 2014;3:1-8. <http://dx.doi.org/10.1177/2048004014529419>. PMID:25247072.

Correspondence

Ricardo Cesar Rocha Moreira
Av. Fredolin Wolf, 3121, casa 28
CEP 82410-330 - Curitiba (PR), Brasil
Tel.: +55 (41) 99102-5271 / +55 (41) 3244-8787
E-mail: ina@onda.com.br

Author information

RCRM - Chief of the Vascular Surgery Division, Hospital Nossa Senhora das Graças.