Management of Carotid Atherosclerosis

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Presentation for Medicare Evidence Development & Coverage Advisory Committee (MEDCAC)

January 25, 2012

Baltimore, MD

Helping Cardiovascular Professionals
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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

Developed in Collaboration with the American Academy of Neurology and Society of Cardiovascular Computed Tomography

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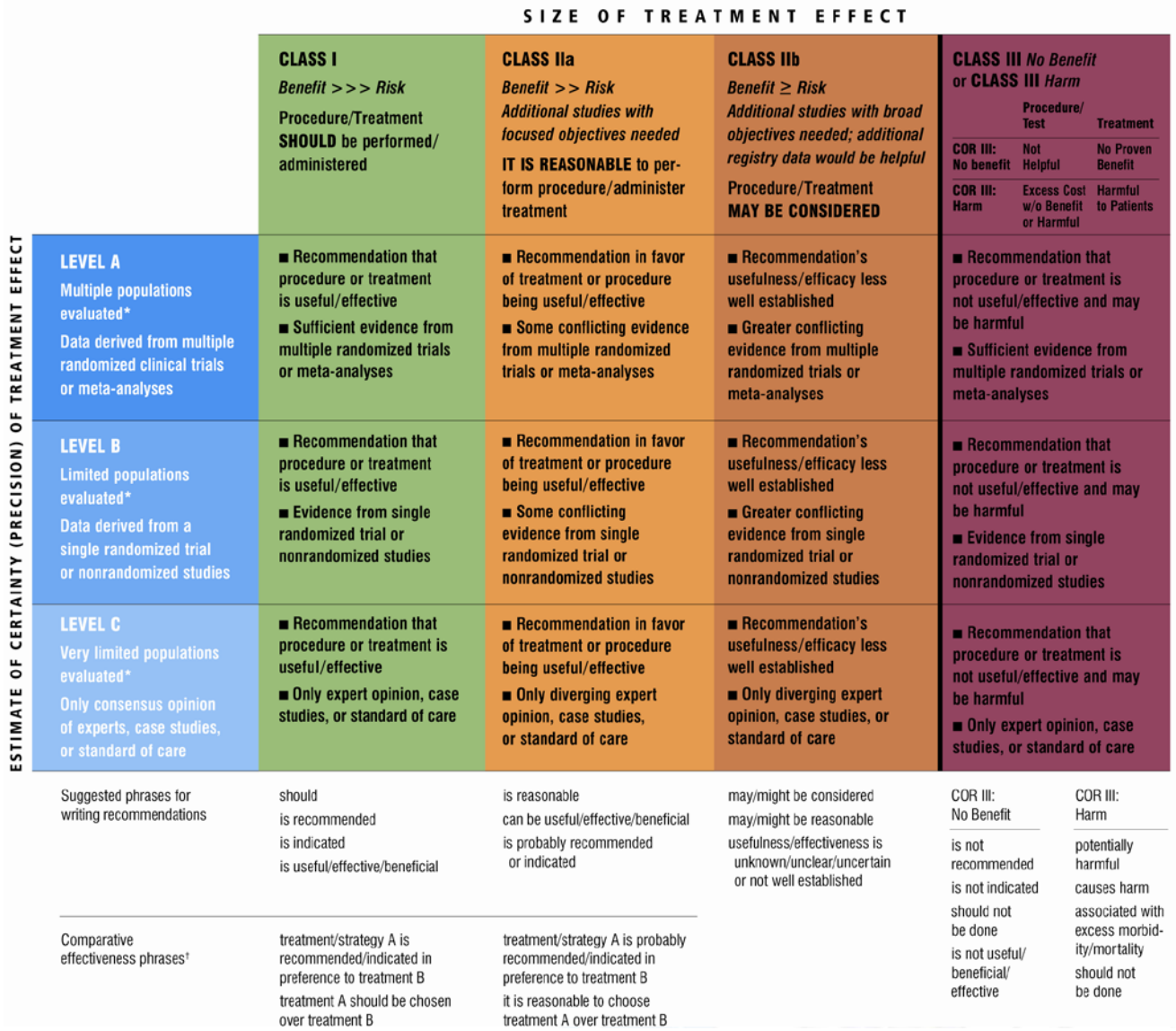
Writing Committee

- Composed of experts in the areas of medicine, surgery, neurology, cardiology, radiology, vascular surgery, neurosurgery, neuroradiology, interventional radiology, noninvasive imaging, emergency medicine, vascular medicine, nursing, epidemiology, and biostatistics

Review & Approval

- The document reviewed by 55 external reviewers.
- All information on reviewers' RWI was distributed to the writing committee and is published.
- Reviewed and approved for publication by the governing bodies of the ASA, ACCF, and AHA and endorsed by the AANN, AANS, ACR, ASNR, CNS, SAIP, SCAI, SCCT, SIR, SNIS, SVM, and SVS. The AAN affirms the value of this guideline.

Classification of Recommendations and Levels of Evidence



SIZE OF TREATMENT EFFECT

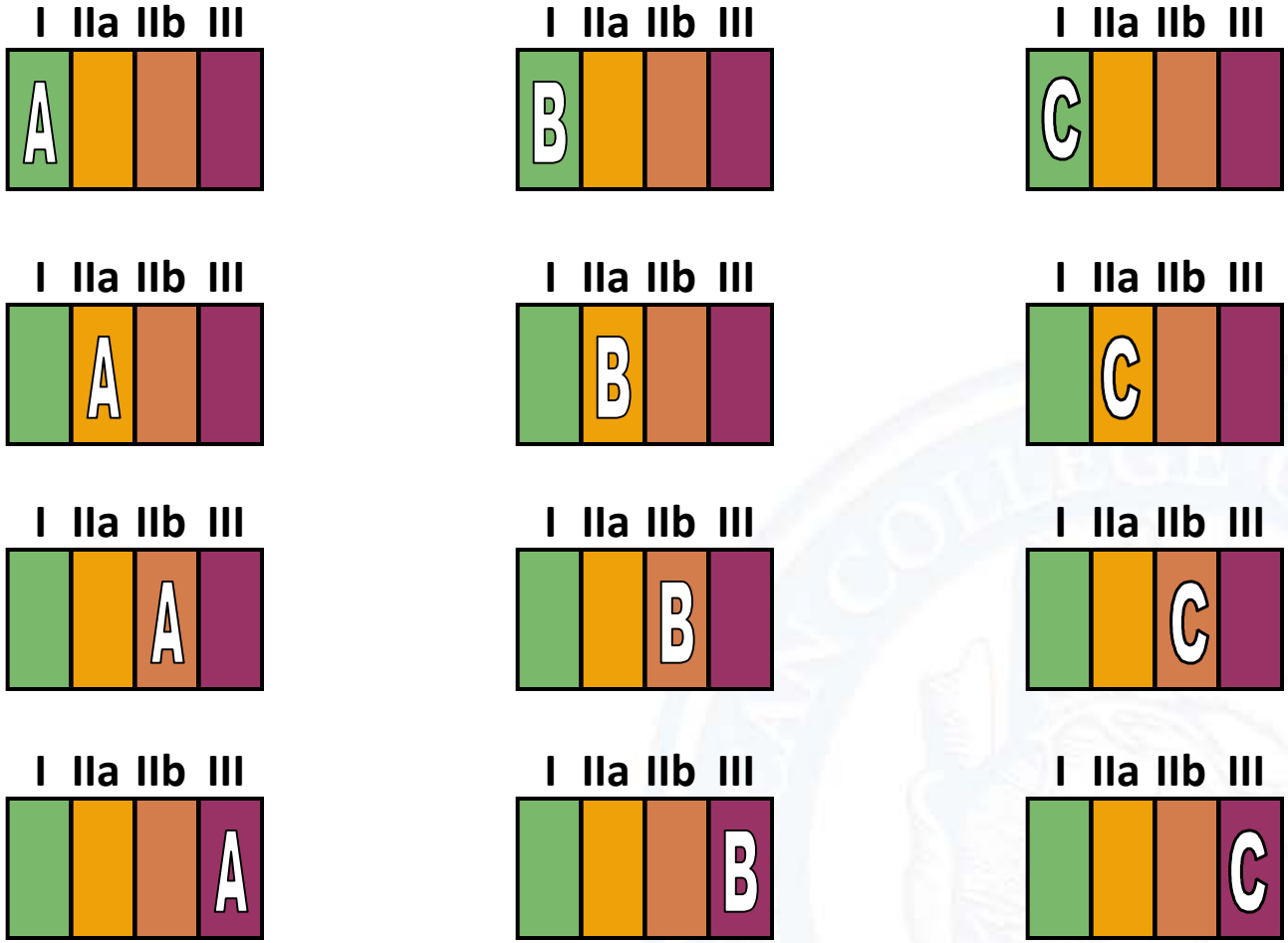
ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT

	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *No Benefit* or CLASS III *Harm* Procedure/Test / Treatment COR III: No benefit — Not Helpful / No Proven Benefit COR III: Harm — Excess Cost w/o Benefit or Harmful / Harmful to Patients
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit: is not recommended; is not indicated; should not be done; is not useful/ beneficial/ effective COR III: Harm: potentially harmful; causes harm; associated with excess morbidity/mortality; should not be done
Comparative effectiveness phrases†	treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B		

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use. A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Even though randomized trials are not available, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

†For comparative effectiveness recommendations (Class I and IIa; Level of Evidence A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

Icons representing the Classification and Evidence Levels for Recommendations



Risk of Stroke in Asymptomatic Patients

- North American Symptomatic Carotid Endarterectomy Trial (NASCET) showed clear correlation between degree of stenosis and risk of stroke.
- The relationship between stroke risk and severity of stenosis in asymptomatic patients was less clear in other studies.
- In the Framingham Heart Study, the calculated age-adjusted incidence of stroke in patients with cervical bruits was 2.6 times that of those without bruits.

CEA Adverse Events

- Symptomatic patients have subsequent stroke rate of 1.1% per year
- Asymptomatic patients, have risk of ipsilateral stroke rate of 0.5% per year (this rate may not be significantly lower than that currently associated with BMT alone)
- Technical considerations
- Patient selection
- Operator experience
- Demographic factors
- Clinical factors

Revascularization

Recommendations for Selection of Patients for Carotid Revascularization*

*Recommendations for revascularization in this section assume that operators are experienced, having successfully performed the procedures in 20 cases with proper technique and a low complication rate based on independent neurological evaluation before and after each procedure.

Recommendations for Selection of Patients for Carotid Revascularization

Patients at average or low surgical risk who experience nondisabling ischemic stroke† or transient cerebral ischemic symptoms, including hemispheric events or amaurosis fugax, within 6 months (symptomatic patients) should undergo CEA if the diameter of the lumen of the ipsilateral internal carotid artery is reduced more than 70%‡ as documented by noninvasive imaging…

or more than 50% as documented by catheter angiography and the anticipated rate of perioperative stroke or mortality is less than 6%.

†Nondisabling stroke is defined by a residual deficit associated with a score ≤2 according to the Modified Rankin Scale.
‡The degree of stenosis is based on catheter-based or noninvasive vascular imaging compared with the distal arterial lumen or velocity measurements by duplex ultrasonography.

Recommendations for Selection of Patients for Carotid Revascularization (continued)

CAS is indicated as an alternative to CEA for symptomatic patients at average or low risk of complications associated with endovascular intervention when the diameter of the lumen of the internal carotid artery is reduced by more than 70% as documented by noninvasive imaging or more than 50% as documented by catheter angiography and the anticipated rate of periprocedural stroke or mortality is less than 6%.

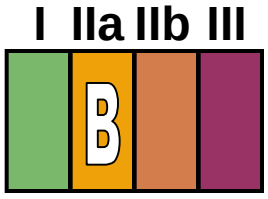
Treatment Strategies for Asymptomatic Patients

Recommendations for Selection of Patients for Carotid Revascularization (continued)

Selection of asymptomatic patients for carotid revascularization should be guided by an assessment of comorbid conditions, life expectancy, and other individual factors and should include a thorough discussion of the risks and benefits of the procedure with an understanding of patient preferences.

Recommendations for Selection of Patients for Carotid Revascularization (continued)

It is reasonable to perform CEA in asymptomatic patients who have more than 70% stenosis of the internal carotid artery if the risk of perioperative stroke, MI, and death is low.



It is reasonable to choose CEA over CAS when revascularization is indicated in older patients, particularly when arterial pathoanatomy is unfavorable for endovascular intervention.

Recommendations for Selection of Patients for Carotid Revascularization (continued)

Prophylactic CAS might be considered in highly selected patients with asymptomatic carotid stenosis (minimum 60% by angiography, 70% by validated Doppler ultrasound), but its effectiveness compared with medical therapy alone in this situation is not well established.

In symptomatic or asymptomatic patients at high risk of complications for carotid revascularization by either CEA or CAS because of comorbidities, the effectiveness of revascularization versus medical therapy alone is not well established.

Treatment Strategies for Asymptomatic Patients Not at High Risk for Stroke

Recommendations for Selection of Patients for Carotid Revascularization (continued)

Prophylactic CAS might be considered in highly selected patients with asymptomatic carotid stenosis (minimum 60% by angiography, 70% by validated Doppler ultrasound), but its effectiveness compared with medical therapy alone in this situation is not well established.

In symptomatic or asymptomatic patients at high risk of complications for carotid revascularization by either CEA or CAS because of comorbidities, the effectiveness of revascularization versus medical therapy alone is not well established.

Recommendations for Selection of Patients for Carotid Revascularization (continued)

Except in extraordinary circumstances, carotid revascularization by either CEA or CAS is not recommended when atherosclerosis narrows the lumen by less than 50%.

Carotid revascularization is not recommended for patients with chronic total occlusion of the targeted carotid artery.

Recommendations for the Treatment of Hypertension

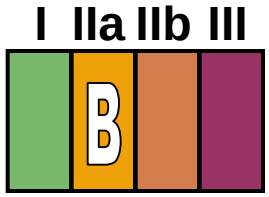
Antihypertensive treatment is recommended for patients with hypertension and asymptomatic extracranial carotid or vertebral atherosclerosis to maintain blood pressure below 140/90 mm Hg (111,228–231).

Recommendation for the Cessation of Tobacco Smoking

Patients with extracranial carotid or vertebral atherosclerosis who smoke cigarettes should be advised to quit smoking and offered smoking cessation interventions to reduce the risks of atherosclerosis progression and stroke.

Recommendations for Control of Hyperlipidemia

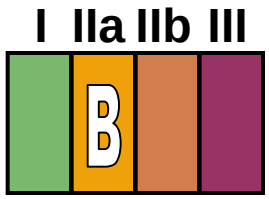
Treatment with a statin medication is recommended for all patients with extracranial carotid or vertebral atherosclerosis to reduce low-density lipoprotein (LDL) cholesterol below 100 mg/dL.



Treatment with a statin medication is reasonable for all patients with extracranial carotid or vertebral atherosclerosis who sustain ischemic stroke to reduce LDL-cholesterol to a level near or below 70 mg/dL.

Recommendations for Control of Hyperlipidemia (continued)

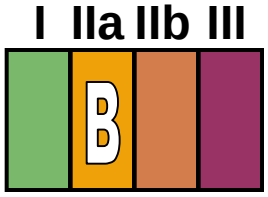
If treatment with a statin (including trials of higher-dose statins and higher-potency statins) does not achieve the goal selected for a patient, intensifying LDL-lowering drug therapy with an additional drug from among those with evidence of improving outcomes (i.e., bile acid sequestrants or niacin) can be effective.



For patients who do not tolerate statins, LDL-lowering therapy with bile acid sequestrants and/or niacin is reasonable.

Recommendations for Management of Diabetes Mellitus

Diet, exercise, and glucose-lowering drugs can be useful for patients with diabetes mellitus and extracranial carotid or vertebral artery atherosclerosis. The stroke prevention benefit, however, of intensive glucose-lowering therapy to a glycosylated hemoglobin A1c level less than 7.0% has not been established.



Administration of statin-type lipid-lowering medication at a dosage sufficient to reduce LDL cholesterol to a level near or below 70 mg/dL is reasonable in patients with diabetes mellitus and extracranial carotid or vertebral artery atherosclerosis for prevention of ischemic stroke and other ischemic cardiovascular events.

Recommendations for Management of Diabetes Mellitus (continued)

Administration of statin-type lipid-lowering medication at a dosage sufficient to reduce LDL cholesterol to a level near or below 70 mg/dL is reasonable in patients with diabetes mellitus and extracranial carotid or vertebral artery atherosclerosis for prevention of ischemic stroke and other ischemic cardiovascular events.

Recommendations for Antithrombotic Therapy

Antiplatelet therapy with aspirin, 75 to 325 mg daily, is recommended for patients with obstructive or nonobstructive atherosclerosis that involves the extracranial carotid and/or vertebral arteries for prevention of MI and other ischemic cardiovascular events, although the benefit has not been established for prevention of stroke in asymptomatic patients.

Recommendations for Antithrombotic Therapy (continued)

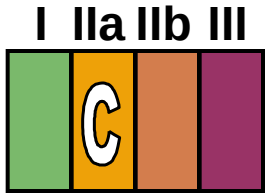
Antiplatelet agents are recommended rather than oral anticoagulation for patients with atherosclerosis of the extracranial carotid or vertebral arteries with ischemic symptoms…

or without ischemic symptoms.

Recommendations for Antithrombotic Therapy (continued)

In patients with extracranial cerebrovascular atherosclerosis who have an indication for anticoagulation, such as atrial fibrillation or a mechanical prosthetic heart valve, it can be beneficial to administer a vitamin K antagonist (such as warfarin, dose-adjusted to achieve a target international normalized ratio [INR] of 2.5 [range 2.0 to 3.0]) for prevention of thromboembolic ischemic events.

Recommendations for Antithrombotic Therapy (continued)



For patients with atherosclerosis of the extracranial carotid or vertebral arteries in whom aspirin is contraindicated by factors other than active bleeding, including allergy, either clopidogrel (75 mg daily) or ticlopidine (250 mg twice daily) is a reasonable alternative.

Screening of Asymptomatic Patients

- Although there is evidence from randomized trials that referred patients with asymptomatic hemodynamically significant carotid stenosis benefit from therapeutic intervention, no screening program aimed at identifying people with asymptomatic carotid stenosis has been shown to reduce their risk of stroke.
- There is no consensus on which patients should undergo screening tests for detection of carotid disease.

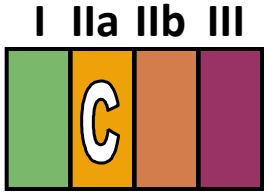
Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)

Carotid duplex ultrasonography is not recommended for routine screening of asymptomatic patients who have no clinical manifestations of or risk factors for atherosclerosis.

Carotid duplex ultrasonography is not recommended for routine evaluation of patients with neurological or psychiatric disorders unrelated to focal cerebral ischemia, such as brain tumors, familial or degenerative cerebral or motor neuron disorders, infectious and inflammatory conditions affecting the brain, psychiatric disorders, or epilepsy.

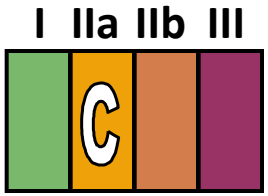
Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis

In asymptomatic patients with known or suspected carotid stenosis, duplex ultrasonography, performed by a qualified technologist in a certified laboratory, is recommended as the initial diagnostic test to detect hemodynamically significant carotid stenosis.



It is reasonable to perform duplex ultrasonography to detect hemodynamically significant carotid stenosis in asymptomatic patients with carotid bruit.

Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)



It is reasonable to repeat duplex ultrasonography annually by a qualified technologist in a certified laboratory to assess the progression or regression of disease and response to therapeutic interventions in patients with atherosclerosis who have had stenosis greater than 50% detected previously. Once stability has been established over an extended period or the patient's candidacy for further intervention has changed, longer intervals or termination of surveillance may be appropriate.

Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)

Duplex ultrasonography to detect hemodynamically significant carotid stenosis may be considered in asymptomatic patients with symptomatic PAD, coronary artery disease (CAD), or atherosclerotic aortic aneurysm, but because such patients already have an indication for medical therapy to prevent ischemic symptoms, it is unclear whether establishing the additional diagnosis of ECVD in those without carotid bruit would justify actions that affect clinical outcomes.

Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)

Duplex ultrasonography might be considered to detect carotid stenosis in asymptomatic patients without clinical evidence of atherosclerosis who have 2 or more of the following risk factors: hypertension, hyperlipidemia, tobacco smoking, a family history in a firstdegree relative of atherosclerosis manifested before age 60 years, or a family history of ischemic stroke. However, it is unclear whether establishing a diagnosis of ECVD would justify actions that affect clinical outcomes.

Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)

Carotid duplex ultrasonography is not recommended for routine screening of asymptomatic patients who have no clinical manifestations of or risk factors for atherosclerosis.

Carotid duplex ultrasonography is not recommended for routine evaluation of patients with neurological or psychiatric disorders unrelated to focal cerebral ischemia, such as brain tumors, familial or degenerative cerebral or motor neuron disorders, infectious and inflammatory conditions affecting the brain, psychiatric disorders, or epilepsy.

Recommendations for Duplex Ultrasonography to Evaluate Asymptomatic Patients With Known or Suspected Carotid Stenosis (continued)

Routine serial imaging of the extracranial carotid arteries is not recommended for patients who have no risk factors for development of atherosclerotic carotid disease and no disease evident on initial vascular testing.

Future Research

- Define more precisely the scope of clinical carotid artery disease as a cause of stroke.
- Investigate imaging techniques to identify carotid plaque vulnerability
- Clarify imaging methods that can reliably identify patients at significantly increased risk of stroke.

Future Research

- Most pressing question is how either CEA or CAS compare with intensive contemporary medical therapy, especially for asymptomatic patients.
- A direct comparative trial of both methods of revascularization versus modern medical management should be initiated as quickly as feasible.
- This trial should include a sufficiently broad range of patients to permit meaningful analysis of subgroups based on age, gender, ethnicity, and risk status.