

CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 71 year old woman with multiple medical problems has a new left sided bruit.

Which of the following imaging studies is the most appropriate first step in evaluation of an asymptomatic bruit?

- (a) catheter angiography of the arch, both carotid, and both vertebral arteries
- (b) ultrasound of the cervical vessels
- (c) magnetic resonance (MR) angiography of the arch and cervical vessels
- (d) computed tomography (CT) angiography of the arch and cervical vessels

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION

A 71 year old asymptomatic woman undergoing an annual wellness check has a left sided bruit.

Which of the following imaging studies is the most appropriate first step in evaluation of an asymptomatic bruit?

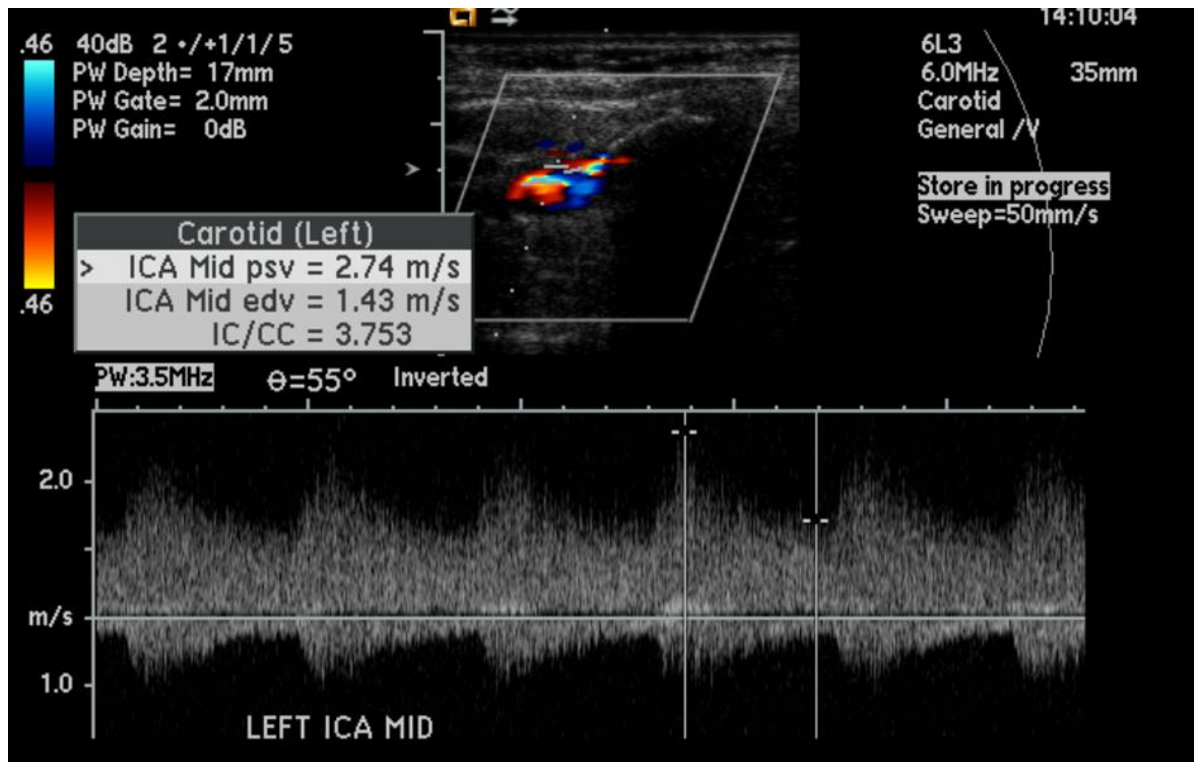
- (a) catheter angiography of the arch, both carotid, and both vertebral arteries
- (b) ultrasound of the cervical vessels
- (c) magnetic resonance (MR) angiography of the arch and cervical vessels
- (d) computed tomography (CT) angiography of the arch and cervical vessels

Answer: (b), ultrasound of the cervical vessels, is the correct response. Ultrasound evaluation is relatively cost effective, involves no ionizing radiation, and does not require the injection of contrast material. It is reasonably sensitive and specific for carotid artery stenosis, aneurysm, and dissection.

Catheter angiography (a), MR angiography (c), and CT angiography (d) are generally much more expensive. Catheter angiography and CT angiography both involve ionizing radiation and injection of iodinated contrast material. MR angiography generally involves injection of gadolinium based contrast material (although unenhanced MR angiography is possible, the images are generally inferior to those obtained with contrast). For these reasons, these studies are generally done only after carotid ultrasound has been performed, and (a), (c), and (d) are therefore incorrect.

IMAGING STUDY AND QUESTIONS

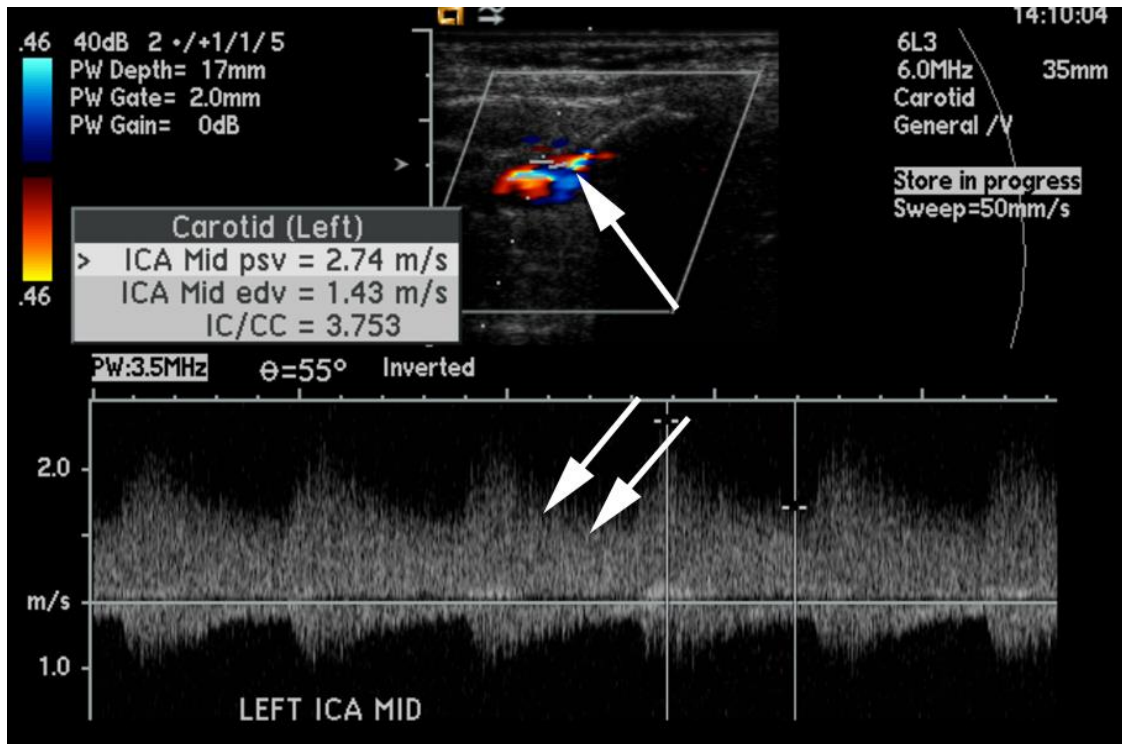
The patient underwent further imaging:



Imaging questions:

- 1) What type of study is shown?
- 2) Are there any abnormalities?
- 3) What is the most likely diagnosis?
- 4) What is the next step in management?

IMAGING STUDY QUESTIONS AND ANSWER



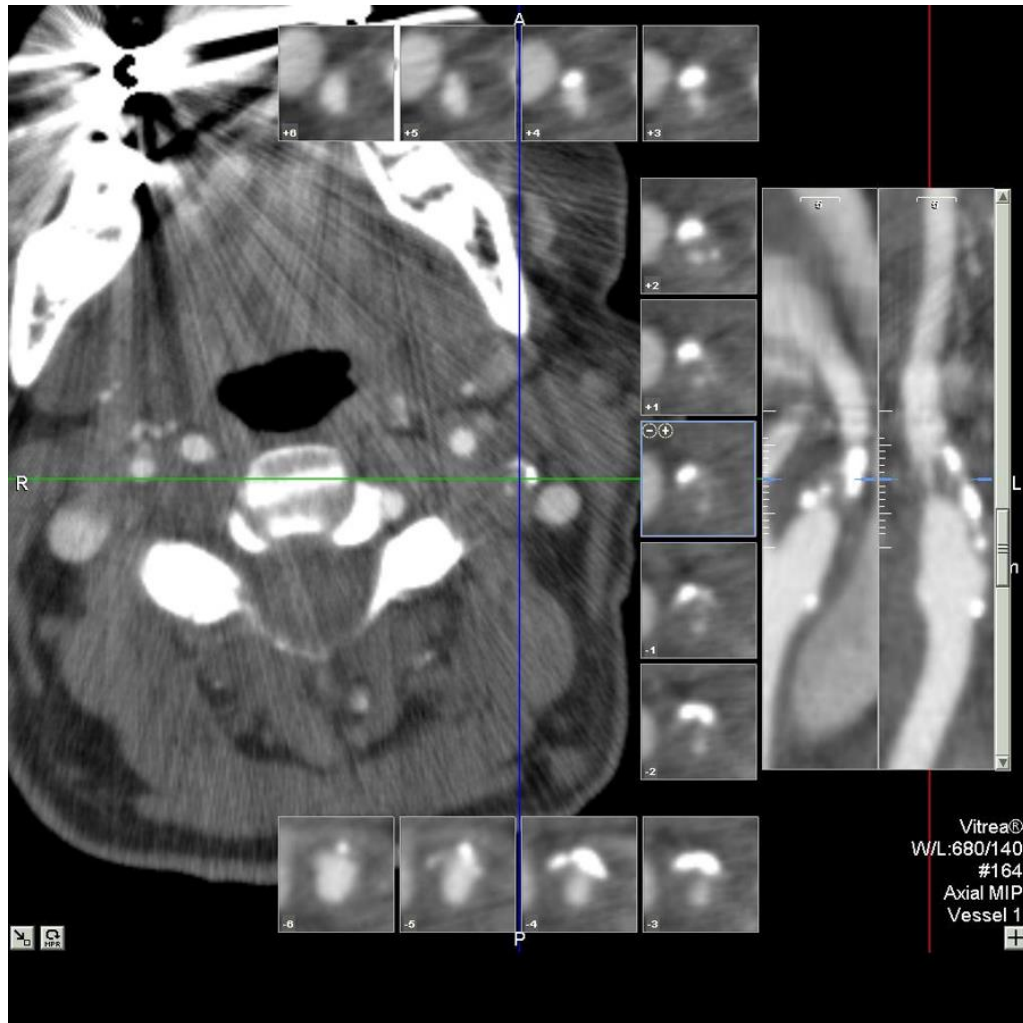
Imaging questions:

- 1) What type of study is shown? A carotid ultrasound study of the carotid arteries.
- 2) Are there any abnormalities? Yes. There is elevated internal carotid artery peak systolic velocity elevation (“ICA Mid psv”) at 2.74 m/s (upper limits of normal is 1.25 m/s), elevated internal artery end diastolic velocity (ICA Mid edv”) at 1.43 m/s (upper limits of normal is 0.4 m/s), and elevated internal carotid artery to common carotid artery peak systolic velocity ratio (“IC/CC”) at 3.73 (upper limits of normal is 2.0). These parameters are generally associated with greater than 70% stenosis of the internal carotid artery. Note that there is also visual narrowing of the internal carotid artery (single arrow) and “broadening” of the spectral waveform on the abnormal left side, both of which are features of arterial stenosis. There should be a narrow range of velocities in the vessel with a relatively narrow line on the spectral Doppler tracing at the bottom of the figure, rather than the broad array of velocities seen at the double arrows.
- 3) What is the most likely diagnosis? Carotid artery stenosis of at least 70%
- 4) What is the next step in management? Consultation with a vascular surgeon, who will likely require additional imaging prior to surgery.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

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The patient underwent a CT angiogram for confirmation of carotid stenosis (see figure below). The patient underwent carotid endarterectomy and a follow-up ultrasound demonstrated return of hemodynamic measurements to normal. The patient did not have any neurologic symptoms either before, during, or after the carotid endarterectomy.



Computed tomography (CT) angiography in a 71 year old woman with a carotid bruit and an abnormal carotid ultrasound study (see figure on Page 4). The large axial image on the left shows carotid artery to be significantly narrowed (at the cross-hairs). The reconstructions along the right side show frontal and lateral maximum intensity projection reconstructions (MIPs) demonstrating severe stenosis in the proximal internal carotid artery. The array of small square images show sequential axial levels proximal and distal to the large image.

SUMMARY

Presenting symptoms: The patient had a carotid artery bruit. A bruit is an abnormal vascular sound which generally indicates turbulent flow such as happens when blood passes by irregularity or through a narrowed vessel. Interestingly, bruits are actually better indicators of vascular disease at locations remote to the bruit rather than at the site of the bruit (e.g., the coronary arteries or lower extremity vessels in patients with carotid bruits), but may indicate significant stenosis of the carotid vessels.

Imaging work-up: Carotid ultrasound is generally the first step in imaging evaluation of carotid bruits because it is less expensive than catheter, CT, and MR angiography, involves no radiation and does not require intravenous or intra-arterial injection of contrast material.

Establishing the diagnosis of carotid stenosis: Carotid ultrasound is a good first step in imaging, but many times vascular surgeons (who treat carotid stenosis with endarterectomy or with vascular stents) or interventional neuroradiologists (who treat carotid stenosis with vascular stents) will require an additional confirmative test in the event that a carotid ultrasound shows hemodynamically significant stenosis. In the carotid, 70% stenosis is generally the cutoff for hemodynamically significant stenosis and for operating on patients with carotid narrowing. Patients with carotid ultrasound showing this level of stenosis typically have angiography of some type (catheter, CT, or MR) performed. One advantage of MR angiography is that it may be combined with MR imaging of the brain at the same time, which allows evaluation of brain parenchyma and documentation of any clinically silent strokes which may have already occurred in the vascular distribution of the narrowed carotid artery.

Take-home message: A carotid bruit may be a sign of carotid stenosis. The best first step in imaging a carotid bruit is usually a carotid ultrasound which will include real-time, color Doppler, and spectral Doppler imaging.

FURTHER READING

Greulich JP, Mohler ER, Fairman RM. Carotid endarterectomy in symptomatic patients. UpToDate, accessed 12/10/09.

McCarron, MO, Goldstein LB, Matchar DB. Screening for asymptomatic carotid artery stenosis. UpToDate, accessed 10/10/09.

Renfrew, DL. Vascular imaging. Chapter 11 of *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.

Wilterdink JL, Furie KL, Kistler JP. Evaluation of carotid artery stenosis. UpToDate, accessed 10/10/09.