Challenges & Pitfalls in Imaging of Carotid Stenosis

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Goals

- Access the results of novel research and world literature on the usage and pitfalls of ultrasound in the evaluation of carotid anatomy and disease.
- Recognize the standard practice guidelines for carotid ultrasonography and optimal scanning techniques and Doppler settings.
- Better understand the potential for operator- and patient-related pitfalls and discrepancies during the performance of carotid ultrasound.

Background

- Stroke is the fourth leading cause of death in the United States according to the Centers for Disease Control and Prevention (CDC).
- Evaluating carotid artery disease (or carotid artery stenosis) is an important step in investigating the etiology of stroke.
- Several imaging modalities are used to screen for carotid stenosis, including carotid ultrasonography, which is one of the least expensive and most well-established imaging modalities to achieve this goal.
- Performing successful carotid sonographic studies requires an awareness of commonly encountered pitfalls, such as technical factors and interpretation errors.
- We reviewed the world literature on the advantages and disadvantages of ultrasound imaging to detect and characterize carotid diseases.

Conclusion

Ultrasound is an excellent modality for diagnosis and surveillance of carotid stenosis since it is non-invasive, relatively accurate, and inexpensive. Knowledge of pitfalls, limitations, and artifacts encountered during an examination will improve the accuracy of the study and enhance risk stratification for stroke therapy.

References


1. Reporting Error (Satisfaction of Search)

A 66 y/o woman presented in Nov 2014 with acute stroke symptoms. MRI confirmed acute stroke in the left hemisphere (a, arrow), as well as severe stenosis/near occlusion in the supraclinoid left internal carotid artery (ICA) (b, arrow). An initial carotid ultrasound suggested total occlusion (c, arrow) of the proximal left ICA. Because of the discrepancy between the MRI and the ultrasound, a repeat carotid ultrasound was performed 7 days later, and revealed that the left ICA was fully patent (d, e, arrows).

2. Limitation in Analysis (High Resistance Flow)

An 87 y/o woman presented to the ED with headaches. The initial CT (not shown) revealed a chronic left middle cerebral artery (MCA) distribution infarct. A follow up MRI two days later confirmed a left MCA infarct (a, arrow). An MRA of the carotid was not performed, but an MRA of the circle of Willis (not shown) did not show significant lesions. A carotid ultrasound performed the next day showed bilateral increased resistive flow in the ICAs (b, c). The implications of this abnormality are unknown.

3. Interpretation Error (Underreporting Carotid Stenosis)

87 y/o woman with dizziness and altered mental status (AMS) presented to the ED on two occasions in Nov and Dec 2014, and each time a CT study (not shown) was done and was normal. A follow up MRI / MRA of the brain in late Dec 2014 for severe AMS showed moderate focal stenosis of the proximal right common carotid artery (CCA) (a, arrow).

A follow up carotid ultrasound showed a right CCA lesion with peak systolic velocity of 319 cm/sec (b, c). Three days later a CT study of the carotid arteries was performed to better visualize the right CCA lesion.

Cross sectional axial images (d, e, arrows) clearly show a severe right CCA lesion (red arrows) compared to a normal left CCA (green arrows). This is confirmed on the 3D rendered images of the diseased right CCA (f, red arrow) and the normal left CCA (g, green arrow).

4. Technical Error (“Aliasing” Artifact)

A 78 y/o woman is being followed for altered mental status and an evolving subacute infarct in the left parietal lobe. An initial carotid ultrasound one year later suggested a mild right ICA stenosis (a, arrow), caused by a marked aliasing artifact in tracing an aliasing artifact.