The Role of Radiology in Acute Ischemic Stroke

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Stroke Classifications

Figure from www.strokecenter.org

Major Sources of Embolic Stroke

- Plaque rupture
- Cardiogenic: A-fib, MI/mural thrombus, prosthetic valves, “paradoxical”

*Images from www.strokecenter.org*
Cerebrovascular Anatomy...

...and Territorial Distribution

L: From www.strokecenter.org; R: From www.utdol.com
The Differential

- Thromboembolic stroke
- Hemorrhagic stroke
- Brain tumor
- Infectious (abscess, encephalitis)
- Head trauma
- Toxic-metabolic (hypoglycemia, uremia, hepatic insufficiency, exogenous drug intoxication)
- Todd’s palsy (paresis, aphasia, neglect, etc. after a seizure episode)
- Complicated migraine
- Conversion reaction
Emergent Diagnostic Tests

- CT of brain w/out contrast.
- ECG
- CXR
- CBC (platelets)
- Coagulation studies
- Serum chemistries, including blood glucose
- Cervical films if trauma is possible.
- ABG if hypoxia is suspected.
- LP if SAH is suspected but no blood or mass effect is seen on CT.
Role of Radiology

Imaging

• CT
• Standard MRI
• DWI/PWI
• CT Angiography
• MR Angiography
• Transcranial Doppler US
• Carotid Duplex US
• Digital Subtraction Angiography
• SPECT
• PET

Interventional

• Intravenous thrombolysis
• Intra-arterial thrombolysis
• Angioplasty
• Stenting
Our Patient Y.C.

• 69 year-old woman with h/o previous R MCA stroke presenting two years later w/ new L PCA and L superior cerebellar stroke.

• Called 911 and said, “I think I’m having a stroke.”

• Found by EMTs slumped against the wall, still clutching phone in R hand, “generally confused,” unable to move.

• Intubated for airway protection at OSH, transferred by helicopter to the stroke unit at BWH.

CT for diagnosis

- Initial study (non-contrast) to differentiate hemorrhage versus infarct. 95% sensitive for intracerebral blood (hyperdense).
- Most infarcts do not become hypodense until 12-24 hours after stroke. 50% begin showing change at 6 hours.
- Triage for possible thrombolysis therapy.

5 hours post symptoms

Old Right MCA stroke
5 hours post symptoms. Notice hypodensity in L superior cerebellum.

24 hours post symptoms. Now hyperdense region—hemorrhagic transformation.
Y.C.: CT to Monitor

S/P EVD placement for hydrocephalus.

S/P craniectomy to decompress posterior fossa.
Y.C.: Diffusion weighted image (DWI) on Admission

- Very sensitive and specific for ischemic areas w/in 6 hours of symptom onset and as early as 30 minutes of ischemia.
- Detection of “cytotoxic edema.”
- Decrease in water diffusion translates to high DWI signal.

New infarcts in L superior cerebellum, L superior cerebral peduncle, and L medial temporal lobe.

7 hours post symptoms
Y.C.: Additional MR Modalities

- Conventional spin-echo imaging provides excellent tissue contrast and resolution of cerebral structures.
- Edema well-imaged: high signal on T2 and PD, low-signal on T1-weighted images.
- After initial CT, MR often used to determine precise location and size of infarct.
- Perfusion-Weighted Imaging (PWI)

T2-weighted image 3 days after symptoms.
Y.C.: MR Angiography

- Useful for determining location of stroke.
- Notice the absence of the left posterior cerebellar artery.

- Does not require vascular catheterization or injected contrast medium.
- MR scanner computer directed to stack axial slices to make 3-D models of the large extra- and intracranial vessels.

7 hours post symptoms
Patient 2: CT Angiography

Filling Defect of L M1 segment with corresponding hypodensity seen on CT.

Patient 3: Percutaneous Transluminal Angioplasty and Stenting

Thrombolysis (rt-PA)

1. Intravenous Thrombolysis
   - Within three hours of onset of symptoms
   - No evidence of hemorrhage or early major infarct
   - No recent history of surgery, head trauma, GIB, LP.

2. Intra-arterial Thrombolysis
   - For ICA, MCA, and basilar artery occlusions
   - +/- mechanical disruption of clot
   - Minimal dose of thrombolytic used.
References


Acknowledgements

• Dr. Chima Ohaegbulem, BWH Department of Neurosurgery, for invaluable assistance.
• Larry Barbaras and Cara Lyn D’amour, our Webmasters
• Dr. Gillian Lieberman
• Pamela Lepkowski