



The Role of Radiology in Acute Ischemic Stroke

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Stroke Classifications

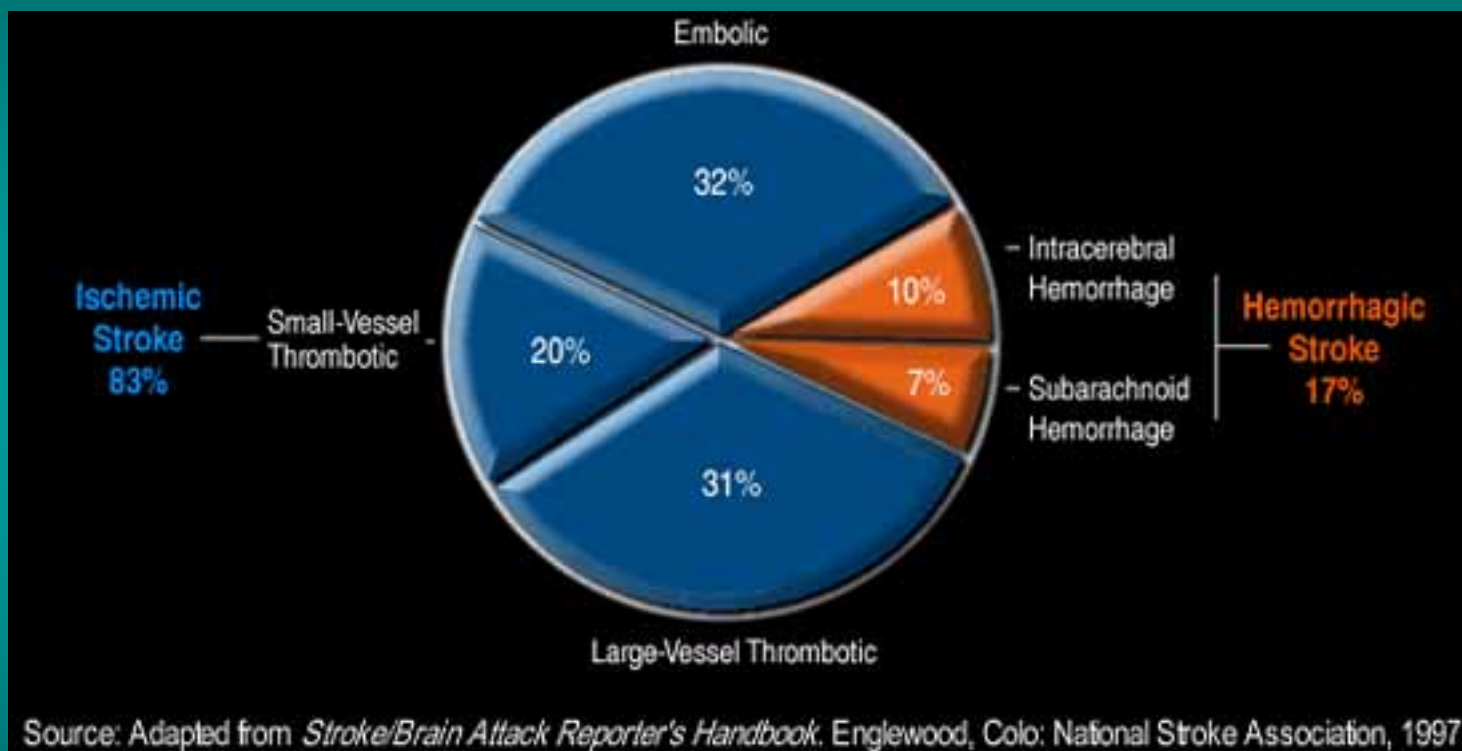
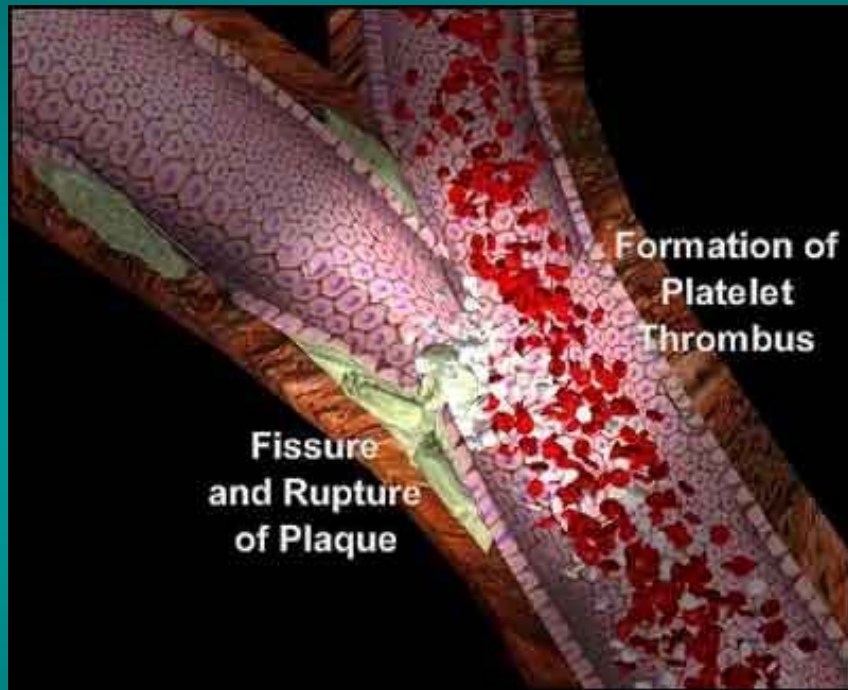


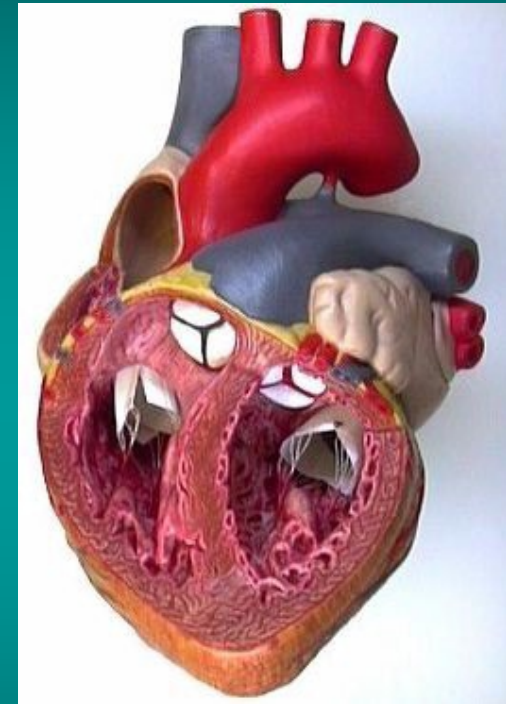
Figure from www.strokecenter.org



Major Sources of Embolic Stroke



Plaque rupture

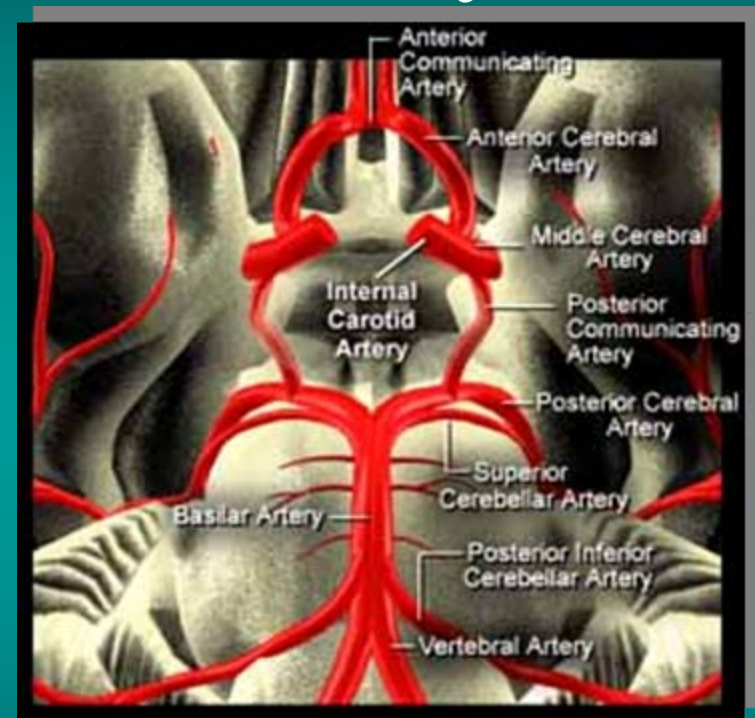
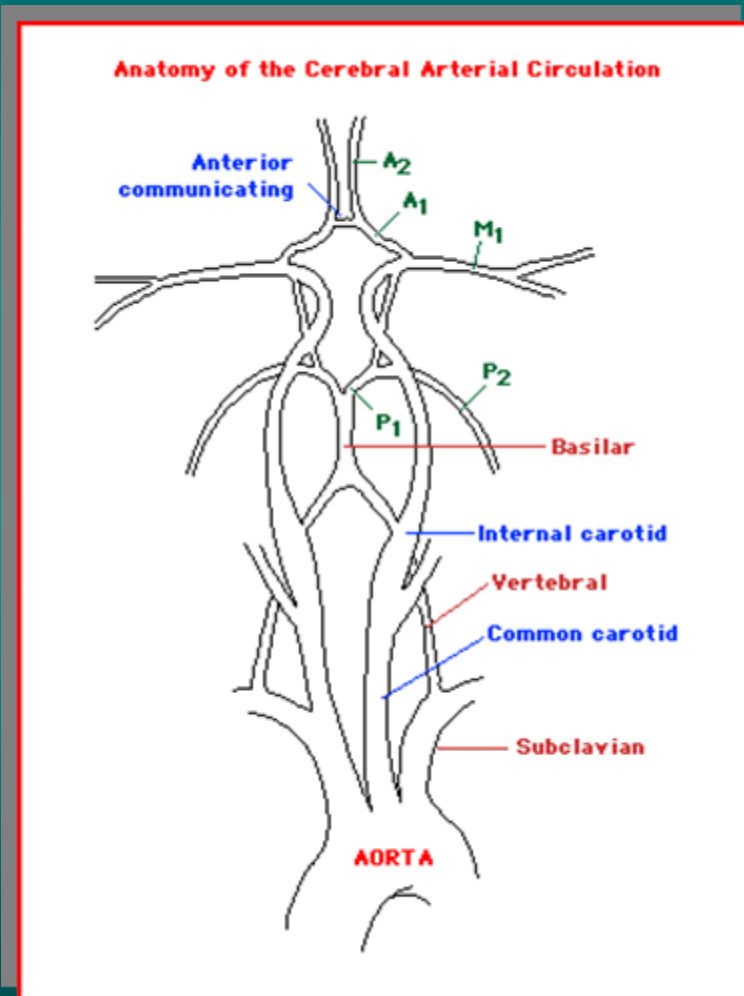


Cardiogenic: A-fib, MI/mural thrombus, prosthetic valves, “paradoxical”

Images from www.strokecenter.org



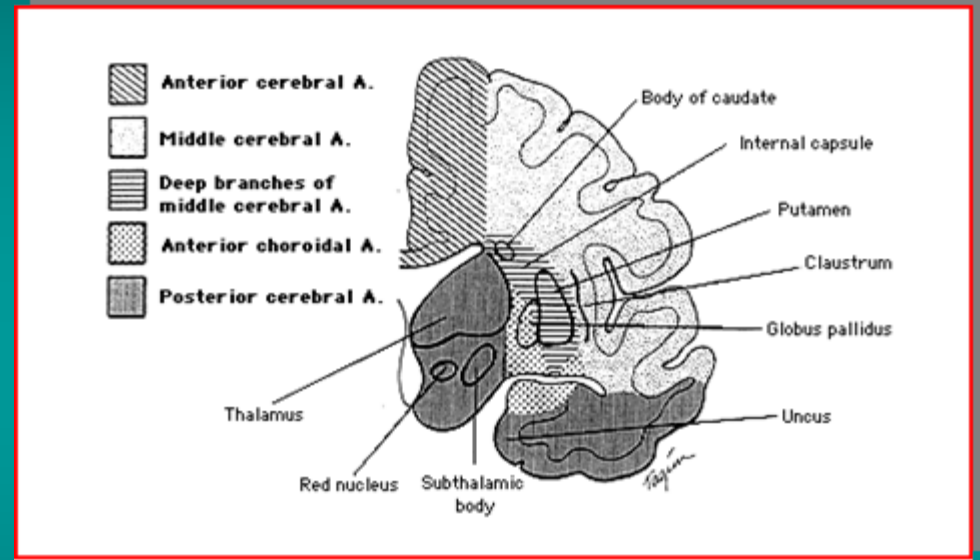
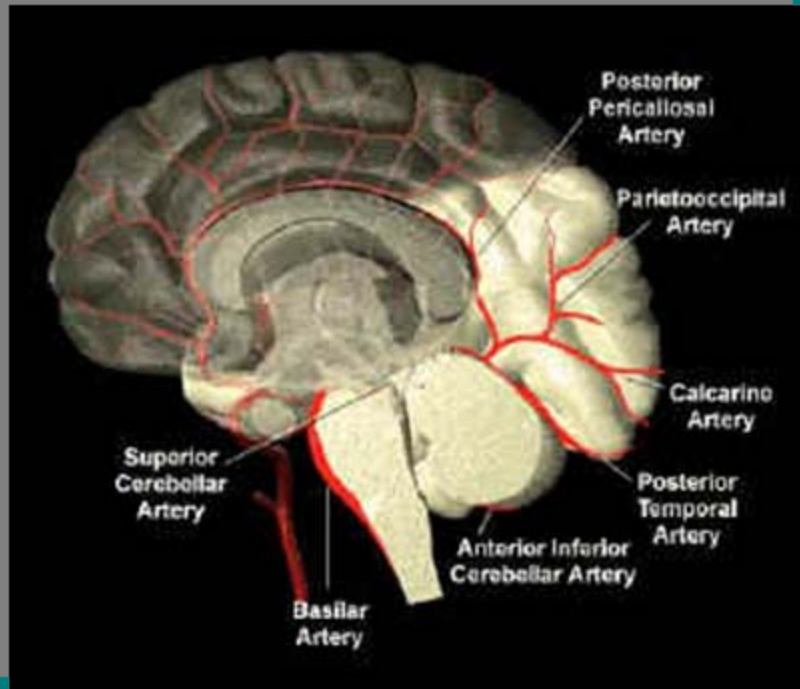
Cerebrovascular Anatomy...



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



...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.
- Focused Differential: 1. Stroke, 2. Stroke, 3. Stroke.



CT for diagnosis



5 hours post symptoms

- 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.

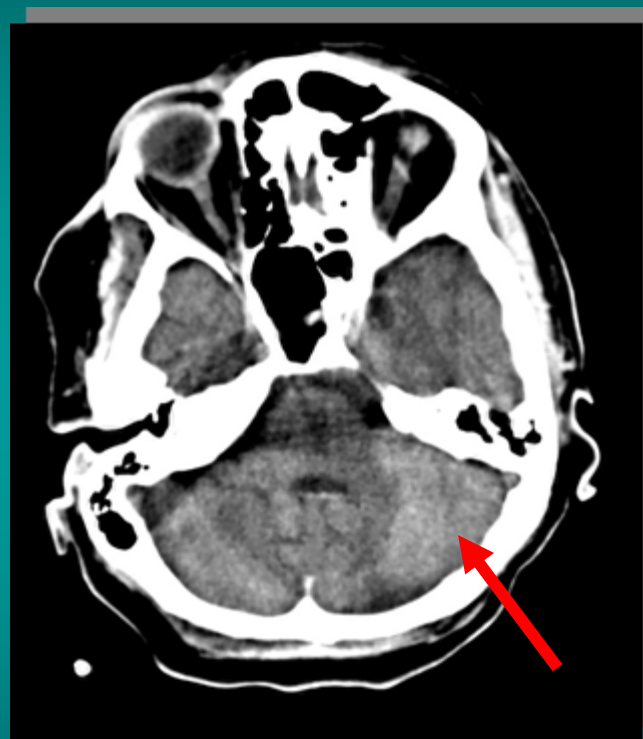
Old Right MCA stroke



Y.C.: CT Cont.



**5 hours post symptoms.
Notice hypodensity in L
superior cerebellum.**



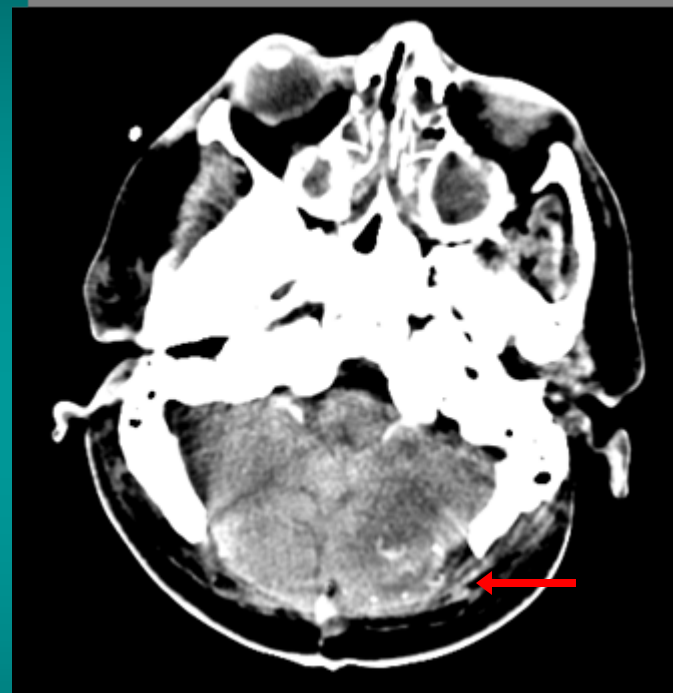
**24 hours post symptoms.
Now hyperdense region—
hemorrhagic
transformation.**



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



7 hours post symptoms

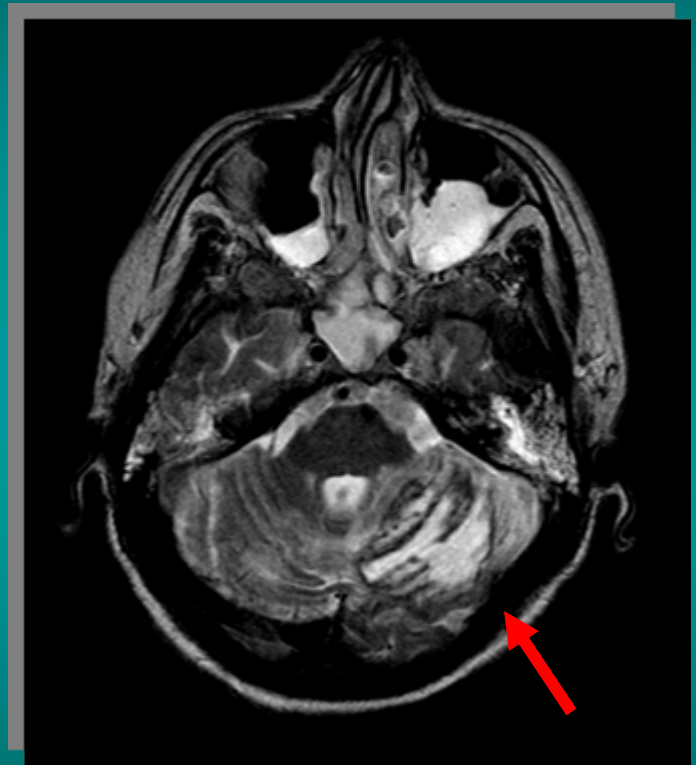
- Very sensitive and specific for ischemic areas w/in 6 hours of symptom onset and as early as 30 minutes of ischemia.
- Detection of “cytotoxic edema.”
- Decrease in water diffusion translates to high DWI signal.

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



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

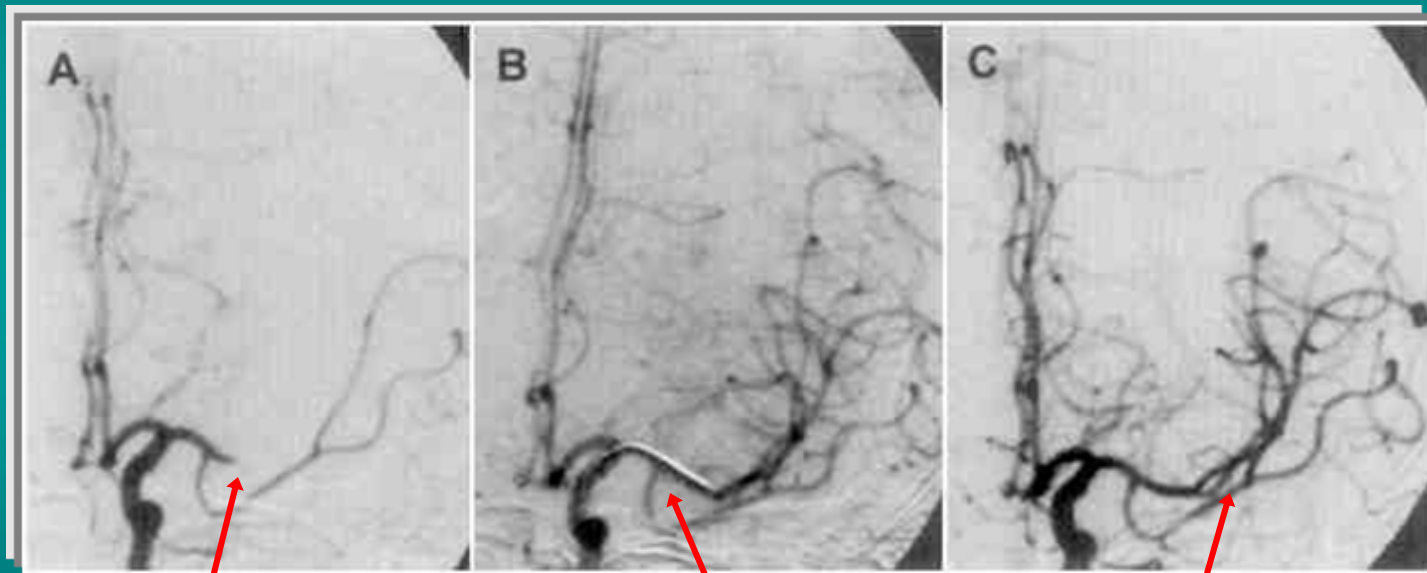


Filling Defect of L M1 segment with corresponding hypodensity seen on CT.

From: Wildermuth: Stroke, Volume 29(5).May 1998.935-938



Patient 3: Percutaneous Transluminal Angioplasty and Stenting



Occluded L M1

Stent

Restored Flow

From: Ueda T., Sakaki S., Nochide I., Kumon Y., Kohno K., Ohta S. Angioplasty after intra-arterial thrombolysis for acute occlusion of intracranial arteries. Stroke. 29(12):2568-74, 1998 Dec.



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.



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