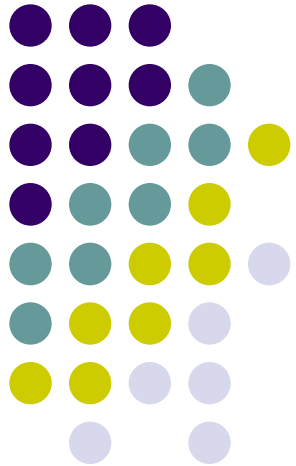
Approach to Acute Stroke in the Emergency Department

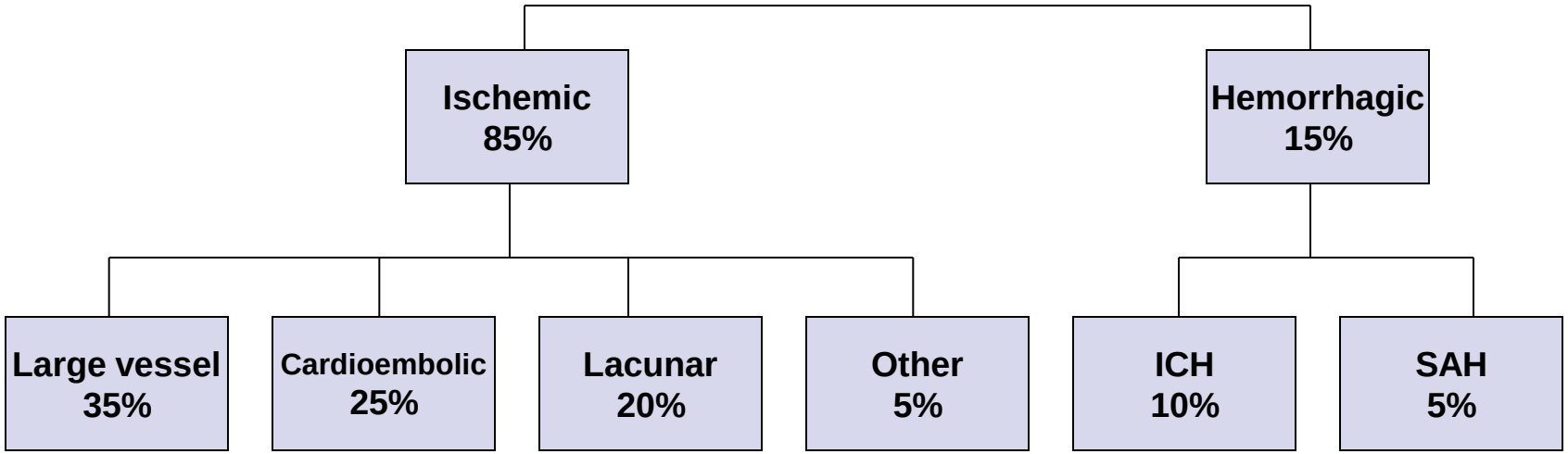
Dr Julia Hopyan



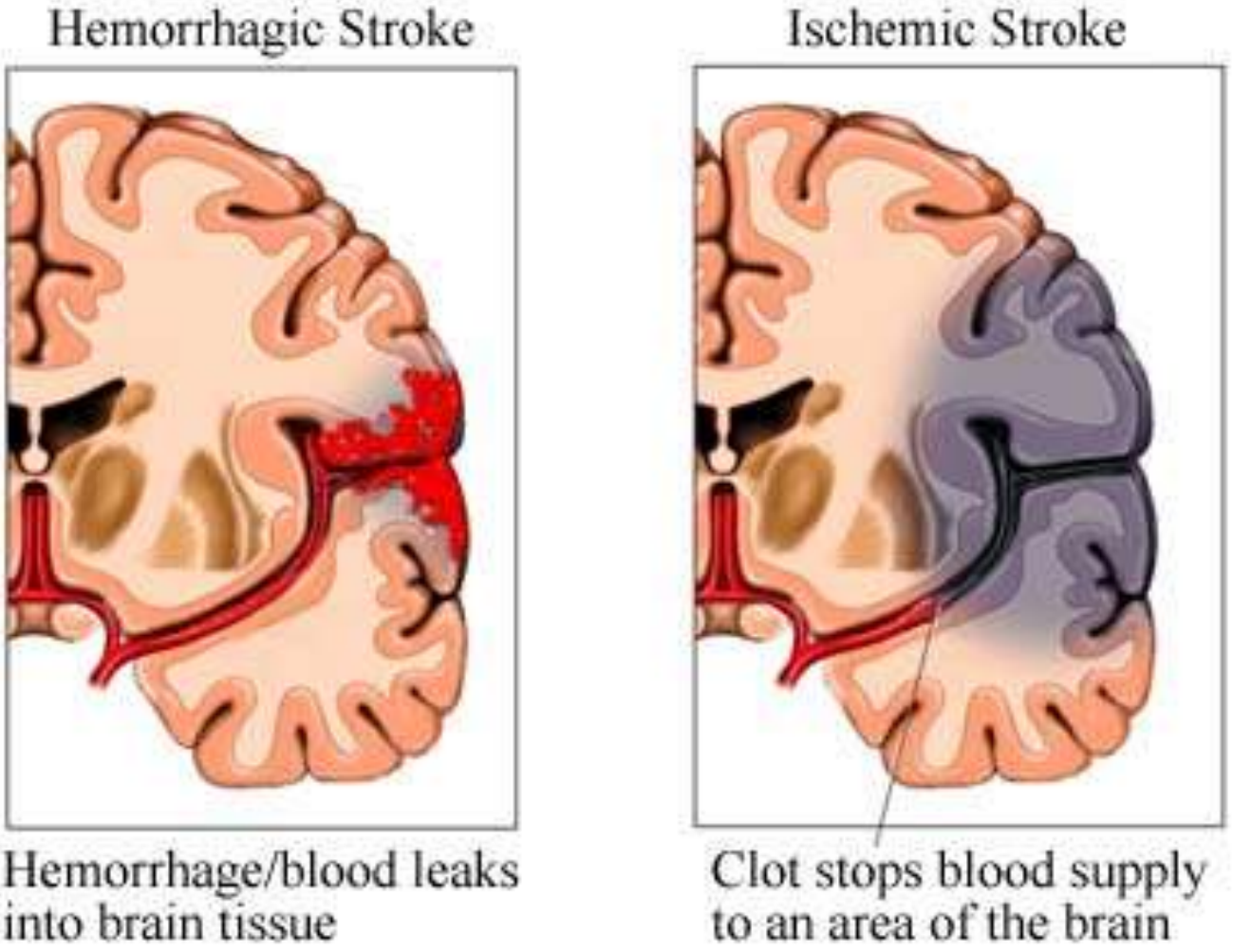
Objectives

- Types of stroke
- Differentiating hemorrhagic and ischemic strokes:
  - Clinically and radiologically
- Stroke syndromes
  - Anterior circulation:
    - Middle cerebral artery
    - Anterior cerebral artery
  - Posterior circulation:
    - Posterior cerebral artery
    - Basilar artery
- Case examples

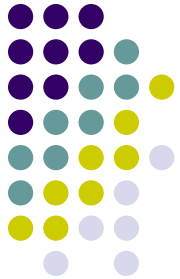
Types of Stroke



Differentiation Between Ischemic versus Hemorrhagic Strokes



Clinical Clues for Detecting Hemorrhagic Stroke



Historical

- Headache
- Sudden onset but gradually worsening
- Nausea and vomiting

Examination Findings

- Decreased level of consciousness
- Hypertension
- Bradycardia
- Seizures
- Meningism
- Fever

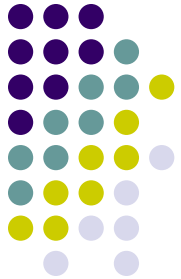
Patients with hemorrhagic stroke present with similar focal neurologic deficits but tend to be more ill than patients with ischemic stroke

Other Clinical Clues

Causes:

- Uncontrolled hypertension
- Anticoagulants
- Coagulopathies
  - Known bleeding diathesis
  - Advanced liver disease
- Elderly with poor cognition (cerebral amyloid angiopathy)
- Known vascular malformations or aneurysms
- Brain tumours

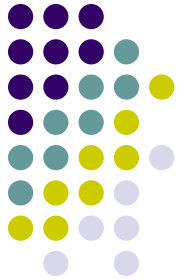
Radiological Hallmarks



Urgent Non-contrast CT scan of the Brain

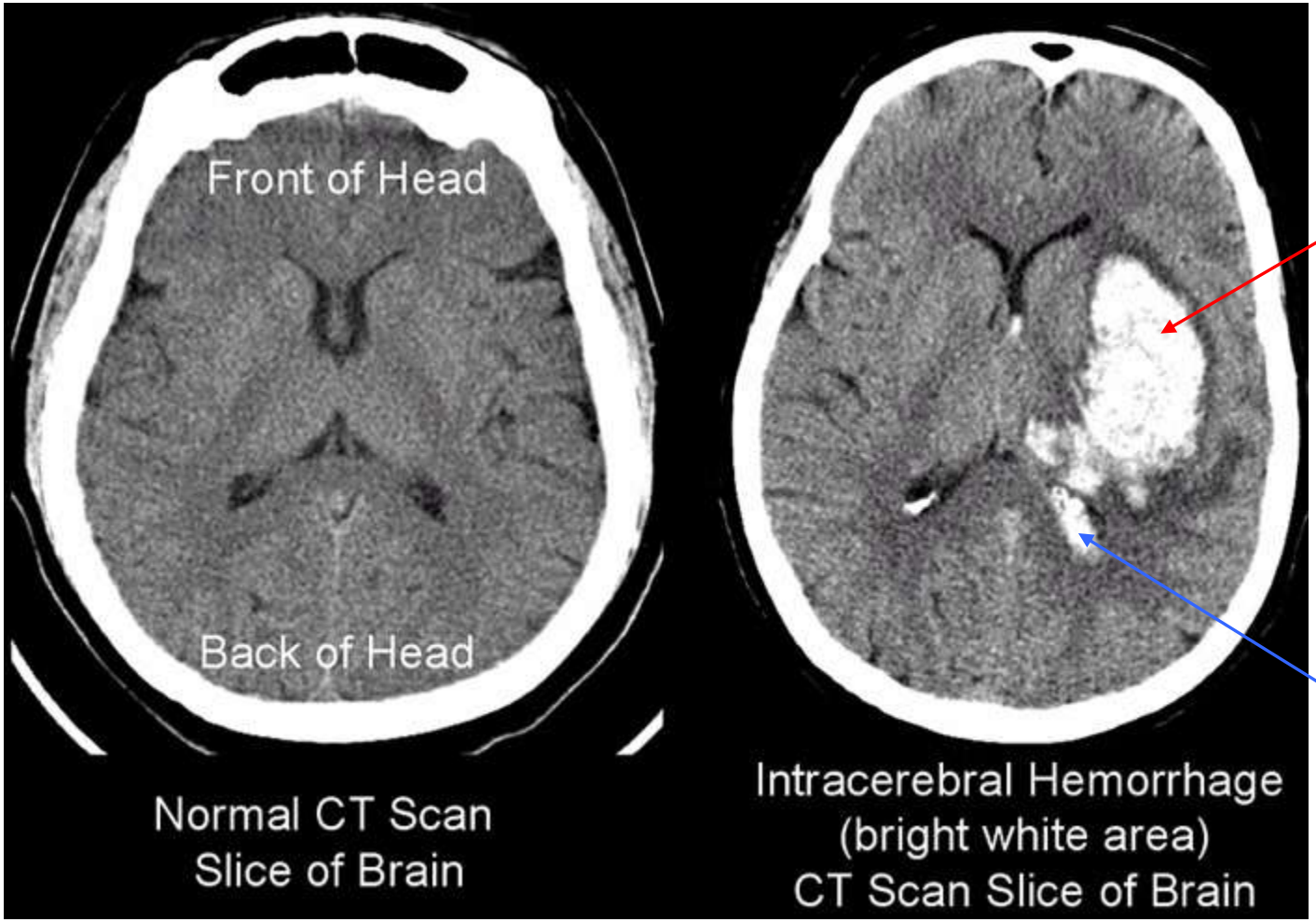
- Blood looks bright white
  - Don’t confuse this with cerebral calcification
- Parenchymal versus subarachnoid
- Location
  - Deep versus lobar
- Volume
- Ventricular extension
- Hydrocephalus

Location of Bleeds



- Deep 50%
- Lobar 35%
- Cerebellum 10%
- Brainstem 5%

66yo M with uncontrolled HT



Large deep ICH affecting left basal ganglia

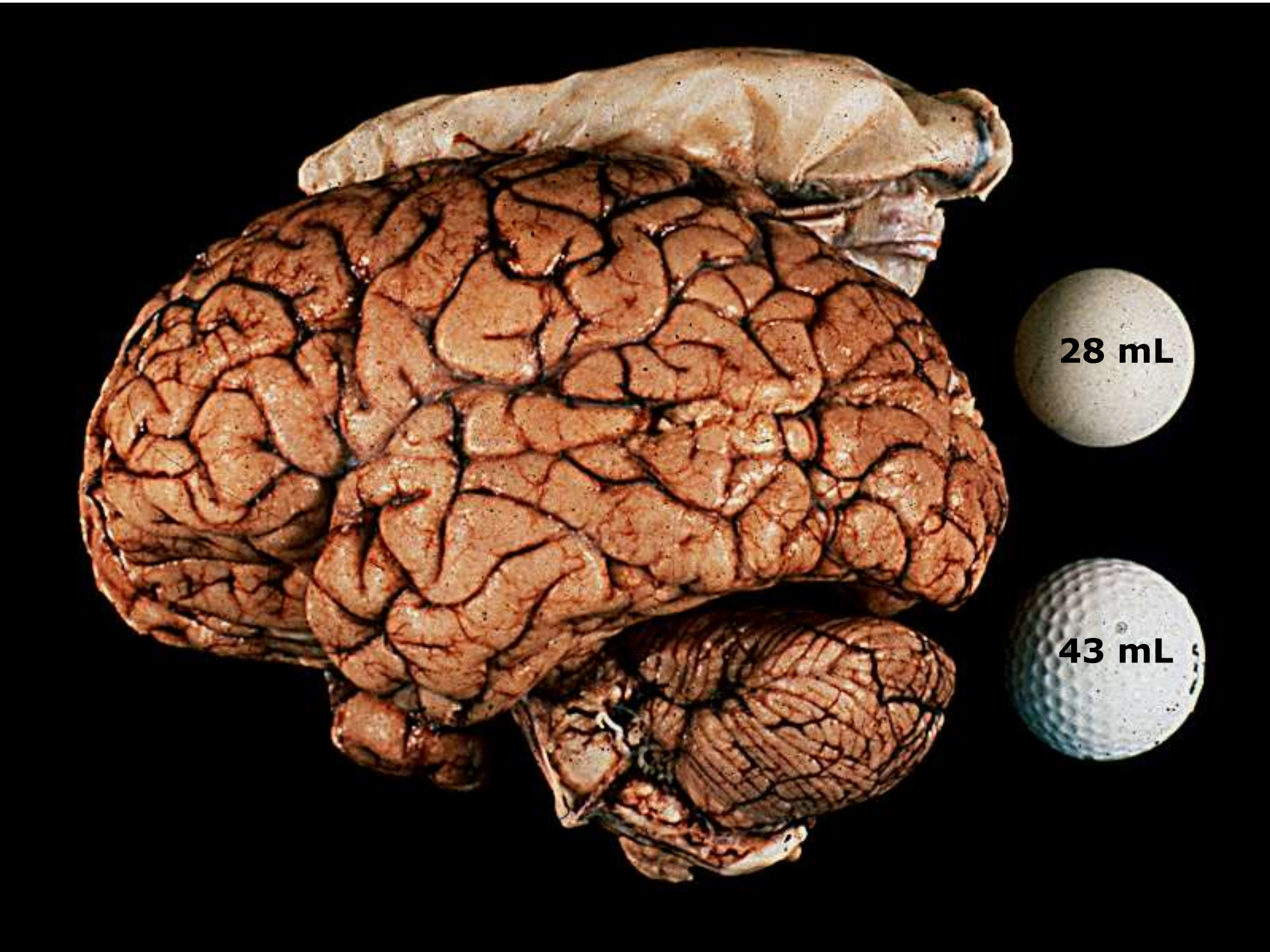
Blood in the left lateral ventricle

87 yo F with dementia

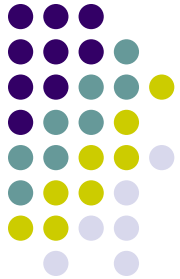
Lobar L occipital ICH

Prognostic Factors in ICH

- Up to 50% mortality rates at 1 year
- Volume of hemorrhage predicts 30 day mortality
  - Poor functional outcomes >30ml ICH
  - >70ml ICH is usually fatal
  - Pontine hemorrhage, >5ml is usually fatal
  - Cerebellar hemorrhage, >30ml is usually fatal


28 mL
43 mL

Prognostic Factors in ICH

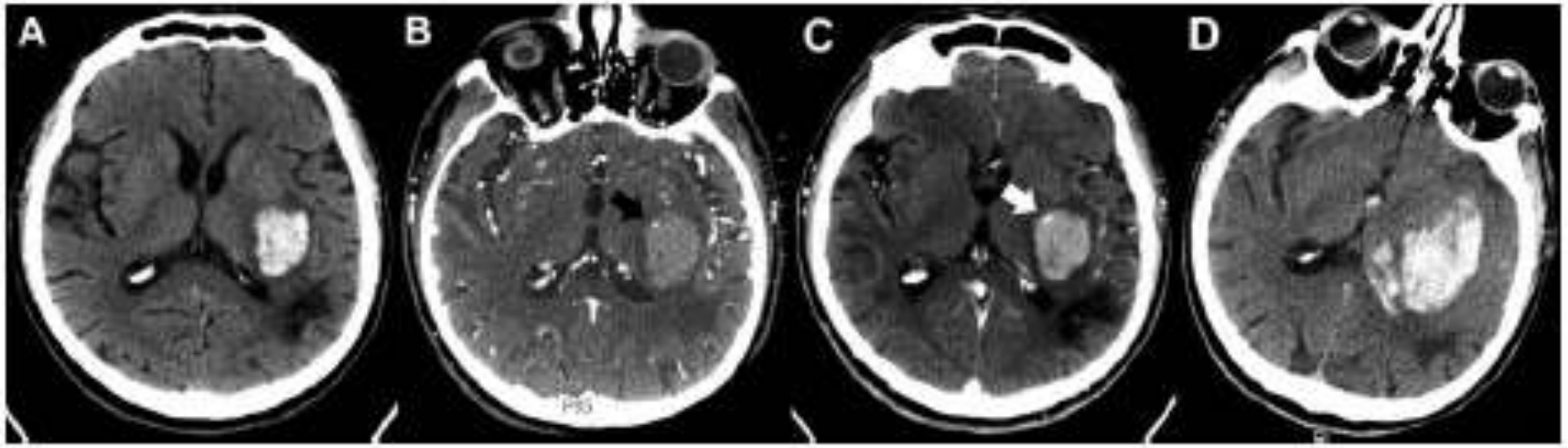


Hematoma Expansion

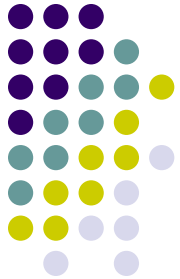
- 40% of hematomas expand by >1/3rd of their volume
- More than 2/3rd of hematomas grow in the first hour
- Hematoma expansion correlates with poor functional outcome

CT Angiography

- Vascular anomalies
- “Spot sign”

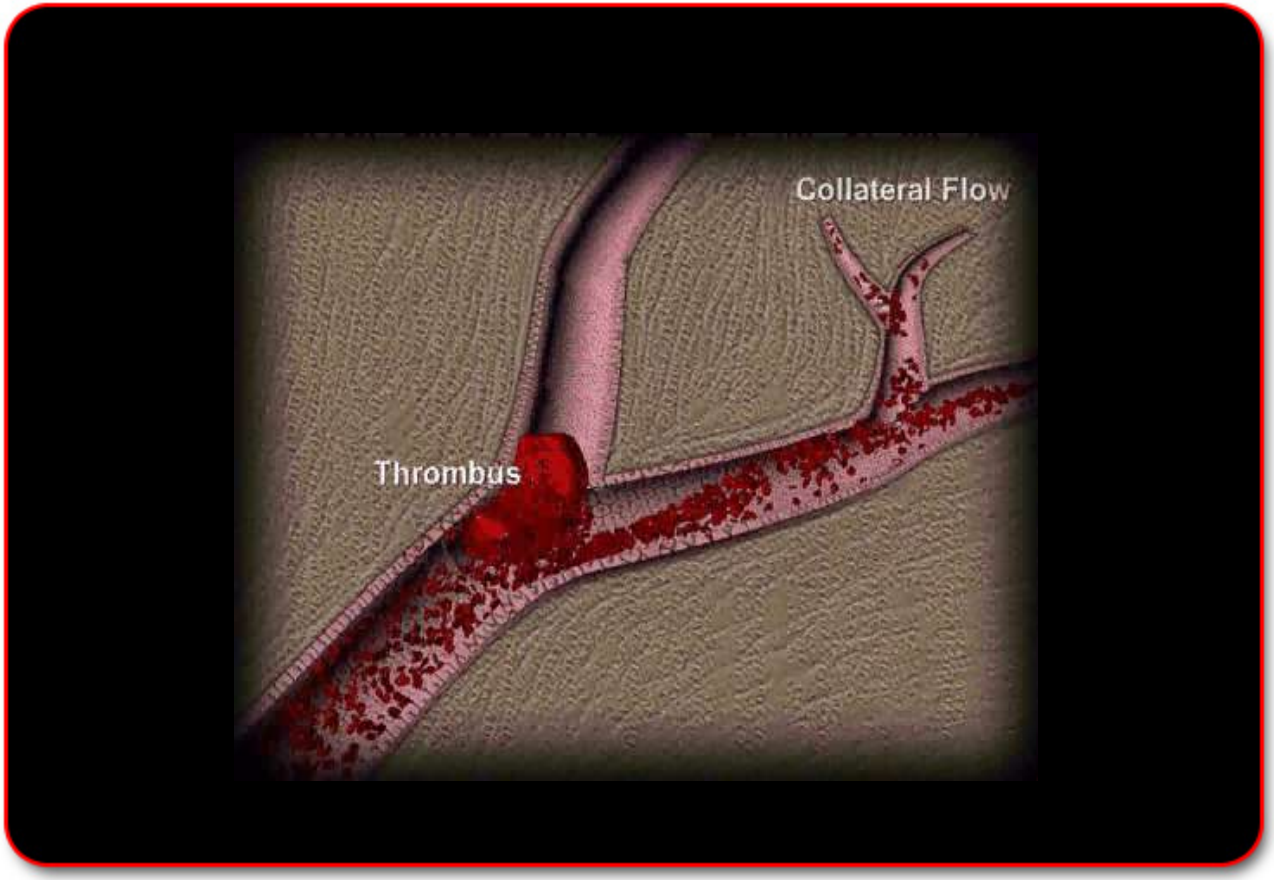


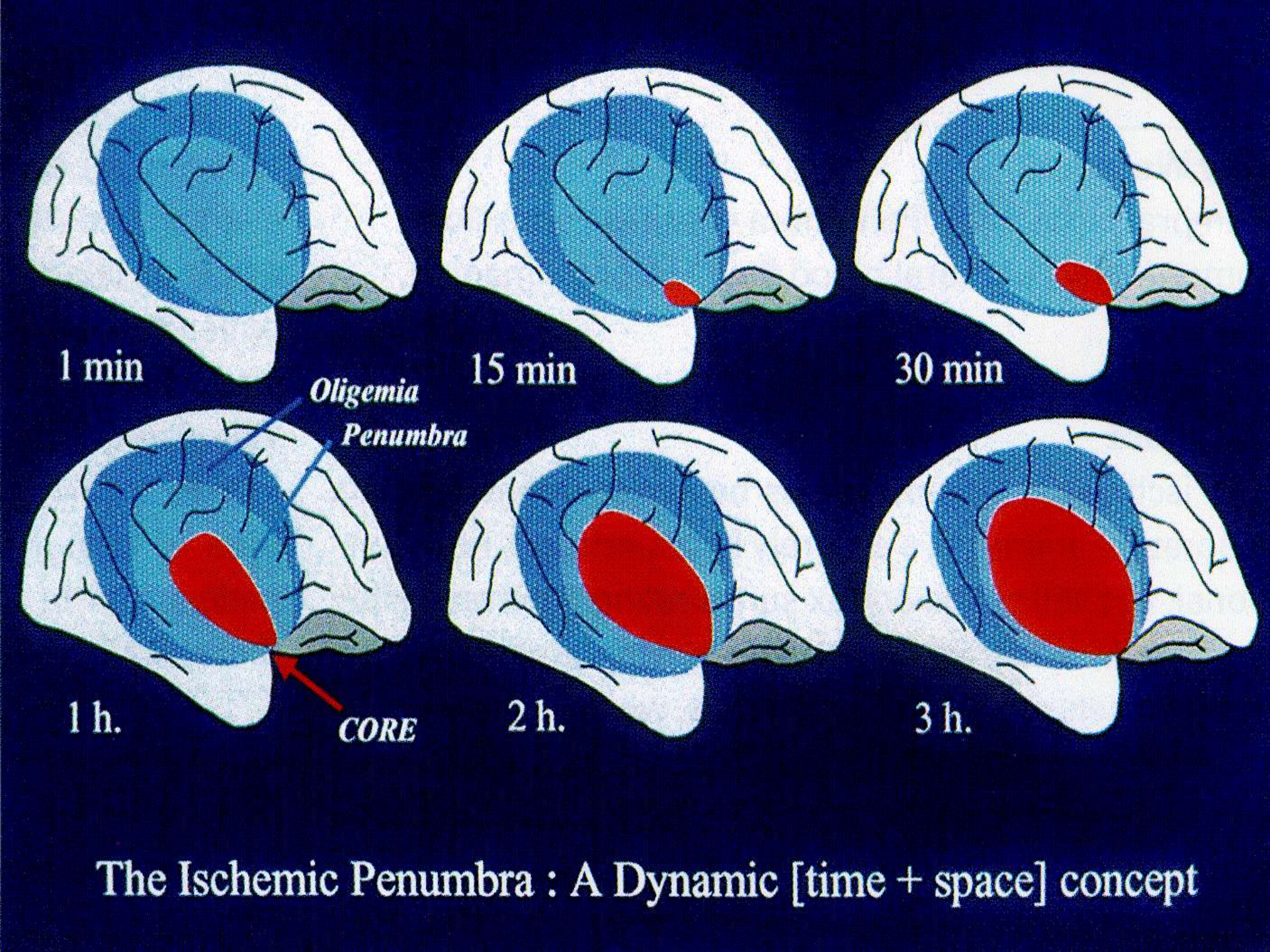
Ischemic Stroke



- Common
  - Every 45 secs, someone has a stroke
- Devastating
  - For every 10 stroke patients:
    - 2 will die
    - 2 will recover
    - 6 will be left with disability
- Potentially treatable (thrombolysis)

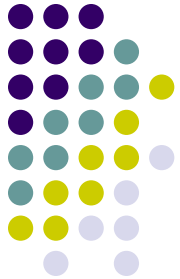
The Ischemic Penumbra





The Ischemic Penumbra : A Dynamic [time + space] concept

Clinical Clues of Ischemic Stroke



Historical Clues

- Cardiovascular risk factors:
  - Smoker
  - HT
  - Hypercholesterolemia
  - Diabetes
  - Family history
- Prothrombotic disorder
- AF
- Cardiomyopathy
- Valvular heart disease

Physical Examination

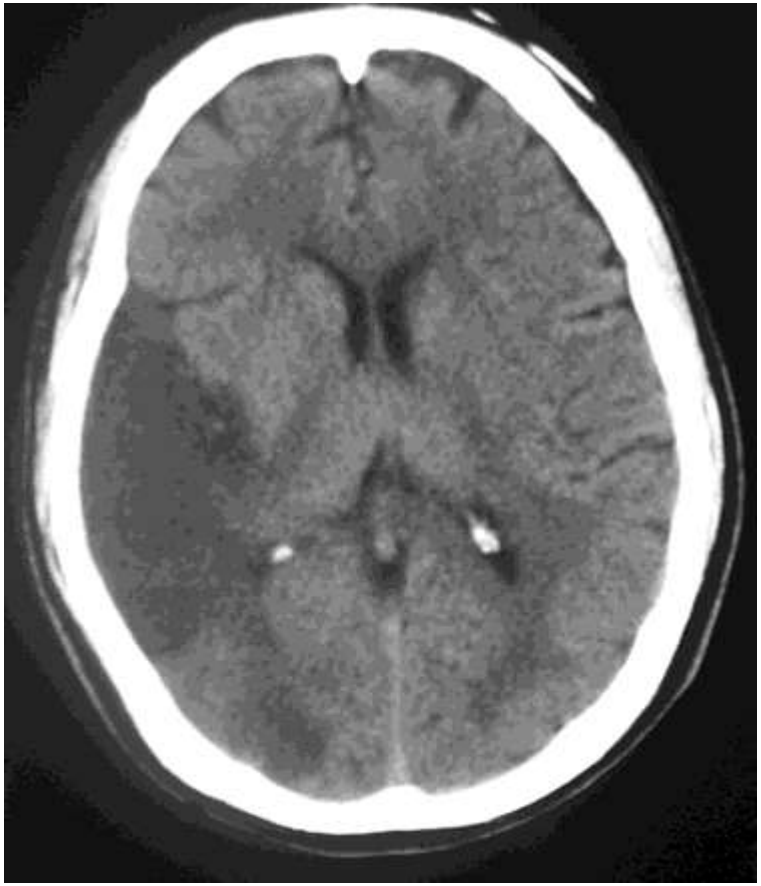
- Stroke syndrome pertaining to one vascular territory

Bottom line:

- You can't differentiate between ischemic and hemorrhagic stroke purely on history and physical examination
- Imaging is required!

Radiological Features of Ischemic Stroke

- Infarcts look hypodense (dark) on CT



Radiological Features of Ischemic Stroke

- Hemorrhagic transformation

Hyperdense Vessel Sign

Ischemic Stroke Syndromes: Middle Cerebral Artery Occlusion

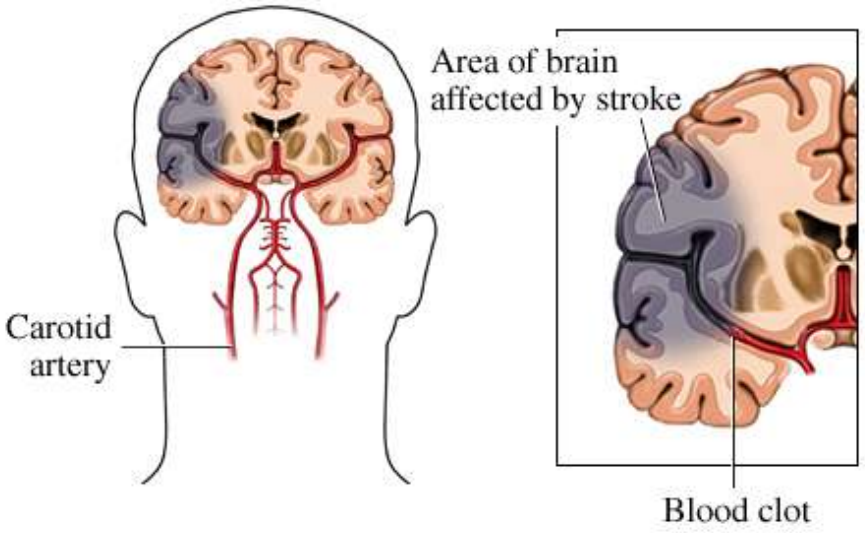
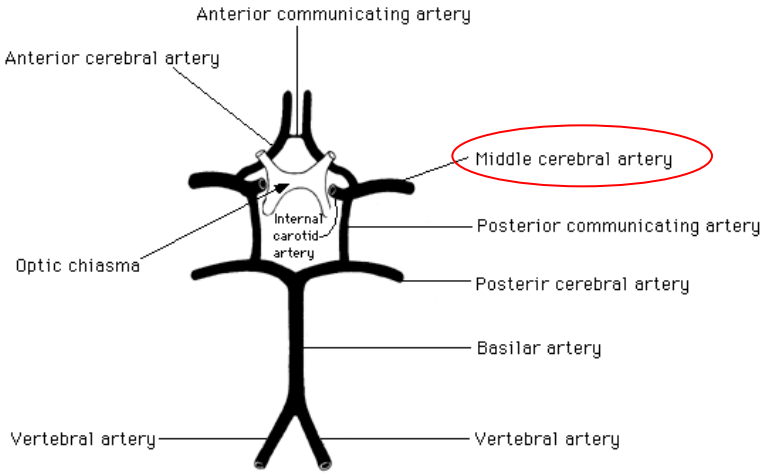
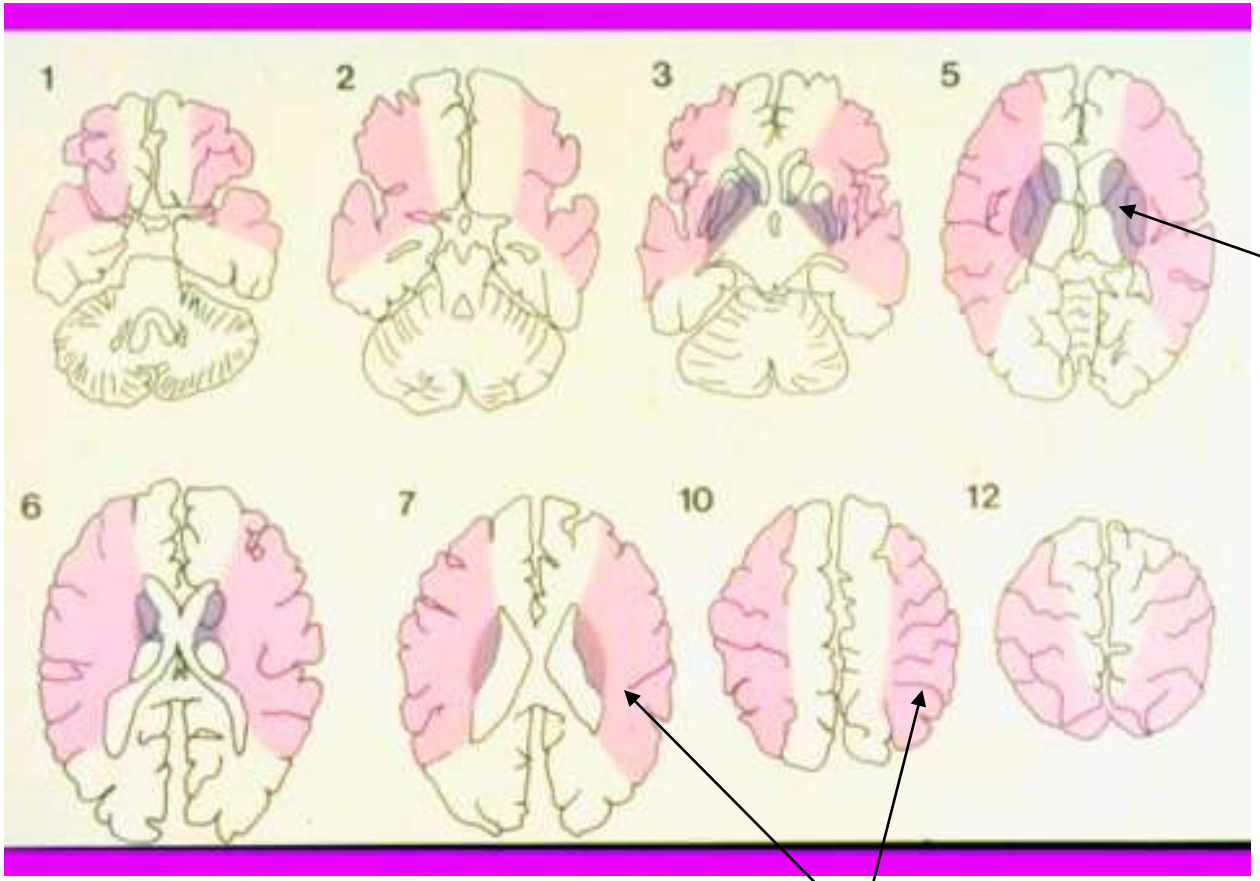


Figure 3A. Schematic diagram of the arteries to the brain, and the circle of Willis.



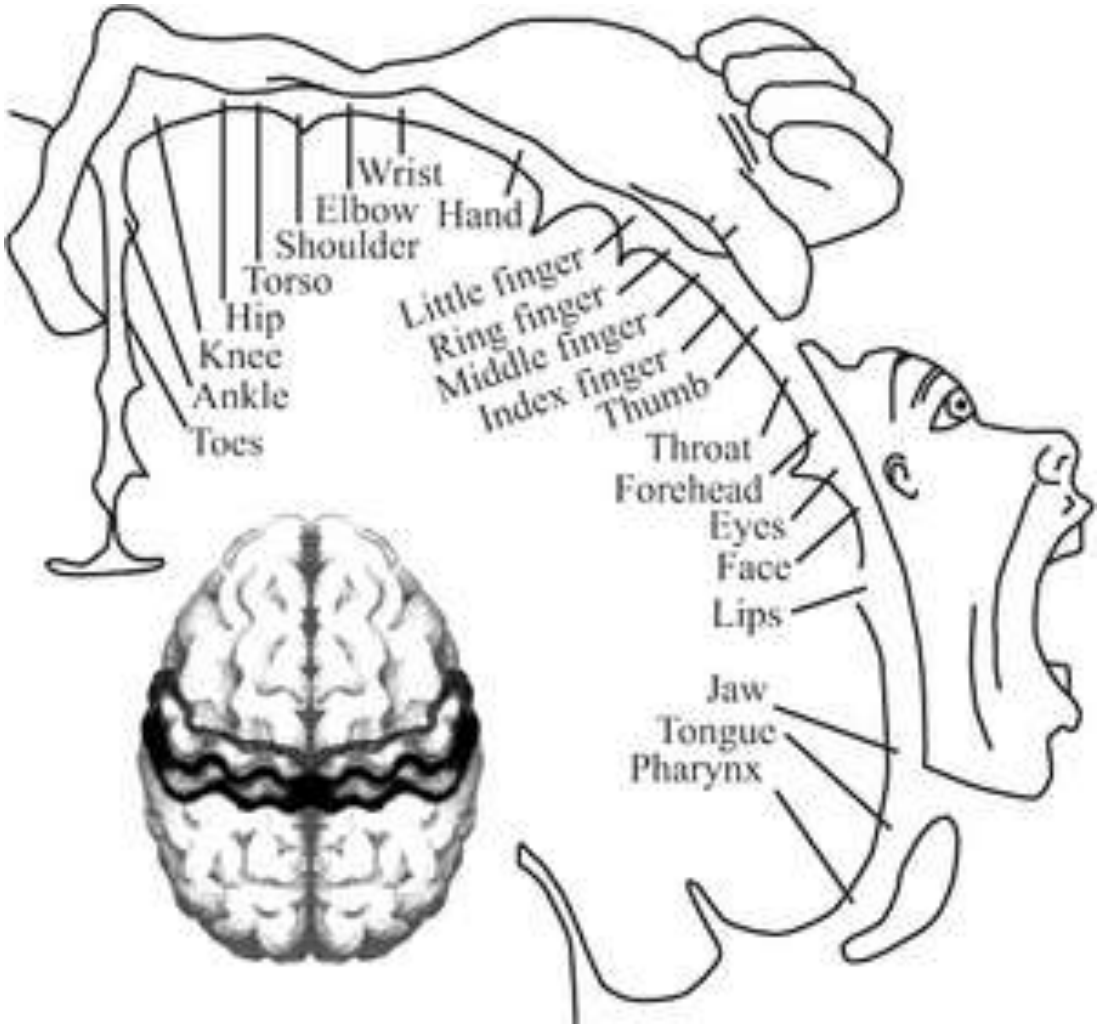
MCA



Basal ganglia and internal capsule

Frontal and parietal and temporal lobes (spares paramedian area)

Homunculus


Wrist
Elbow
Hand
Shoulder
Torso
Hip
Knee
Ankle
Toes
Little finger
Ring finger
Middle finger
Index finger
Thumb
Throat
Forehead
Eyes
Face
Lips
Jaw
Tongue
Pharynx

Middle Cerebral Artery

- Contralateral hemiparesis (face, arm>leg)
- Contralateral hemisensory impairment
- Contralateral homonymous hemianopia

- Specific hemispheric signs:
  - Left (dominant hemisphere)
    - Aphasia (expressive, receptive, global)
  - Right
    - Dysarthria
    - Neglect

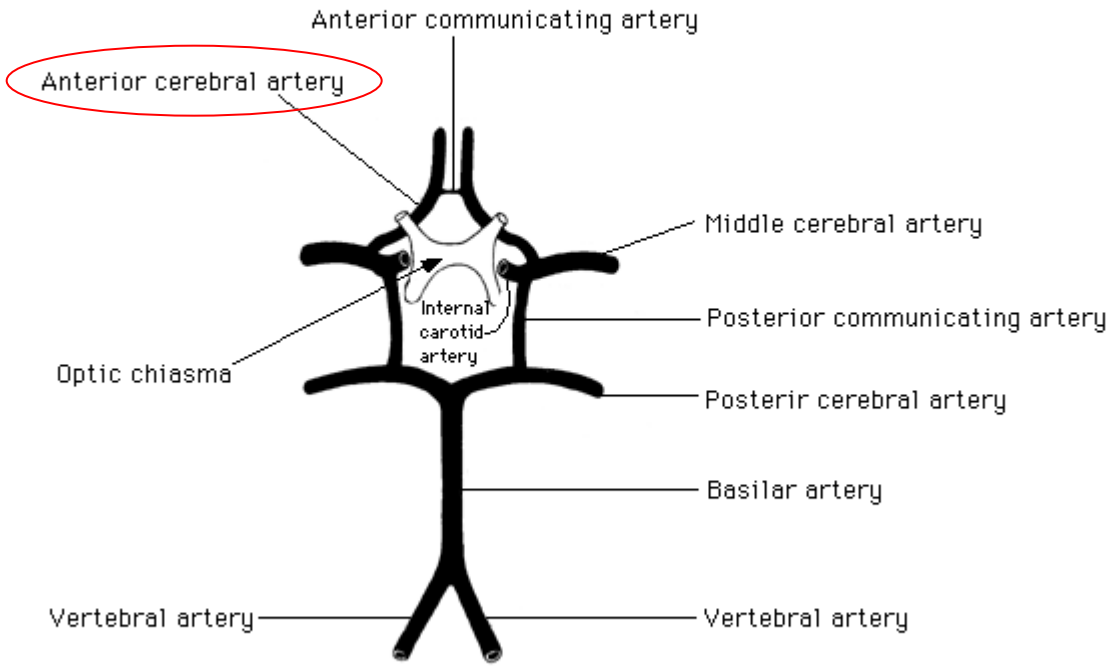
MCA Infarct on Non-Contrast CT Brain

Large MCA territory infarct with hemorrhagic transformation

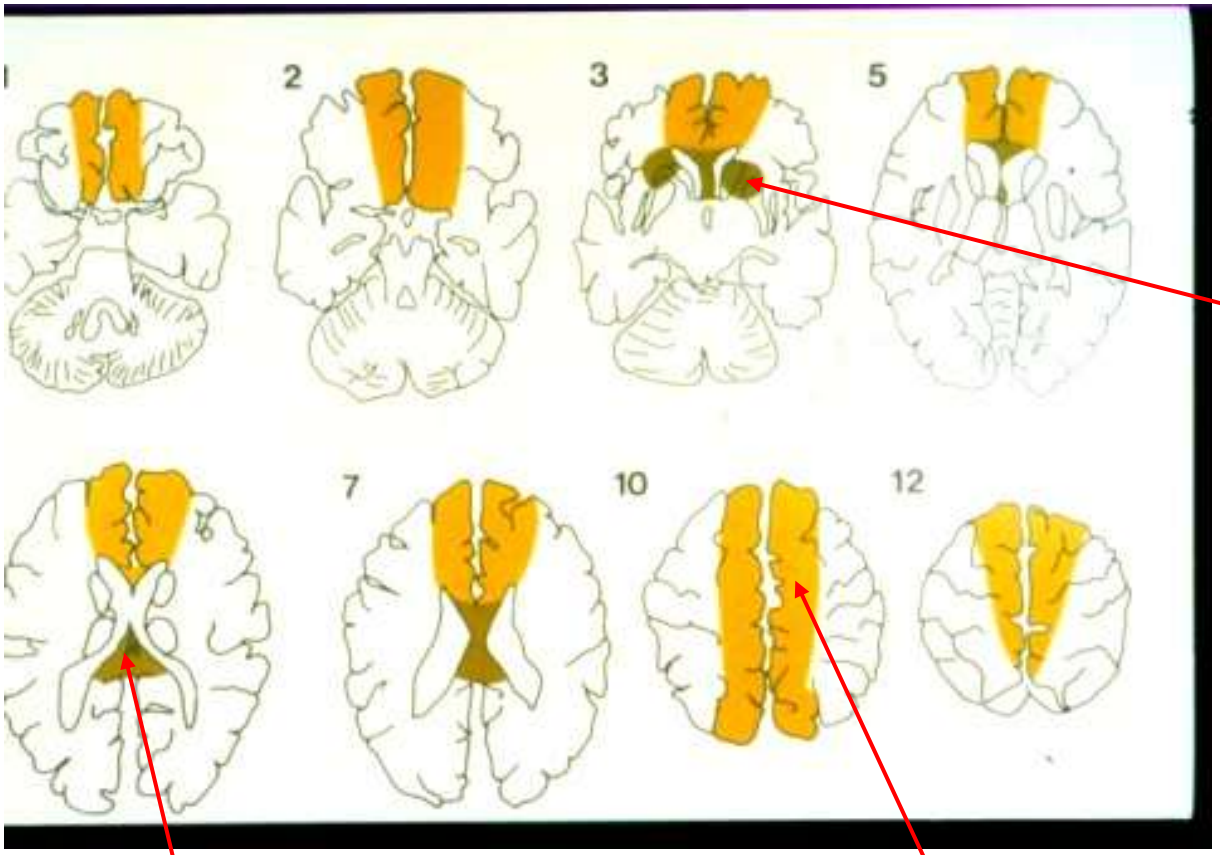
The MCA supplies the frontal, temporal and parietal lobes

Ischemic Stroke Syndromes: Anterior Cerebral Artery Occlusion

Figure 3A. Schematic diagram of the arteries to the brain, and the circle of Willis.



ACA

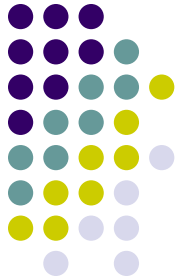


Caudate and anterior limb of internal capsule

Corpus callosum

Paramedian frontal and parietal lobes

Anterior Cerebral Artery

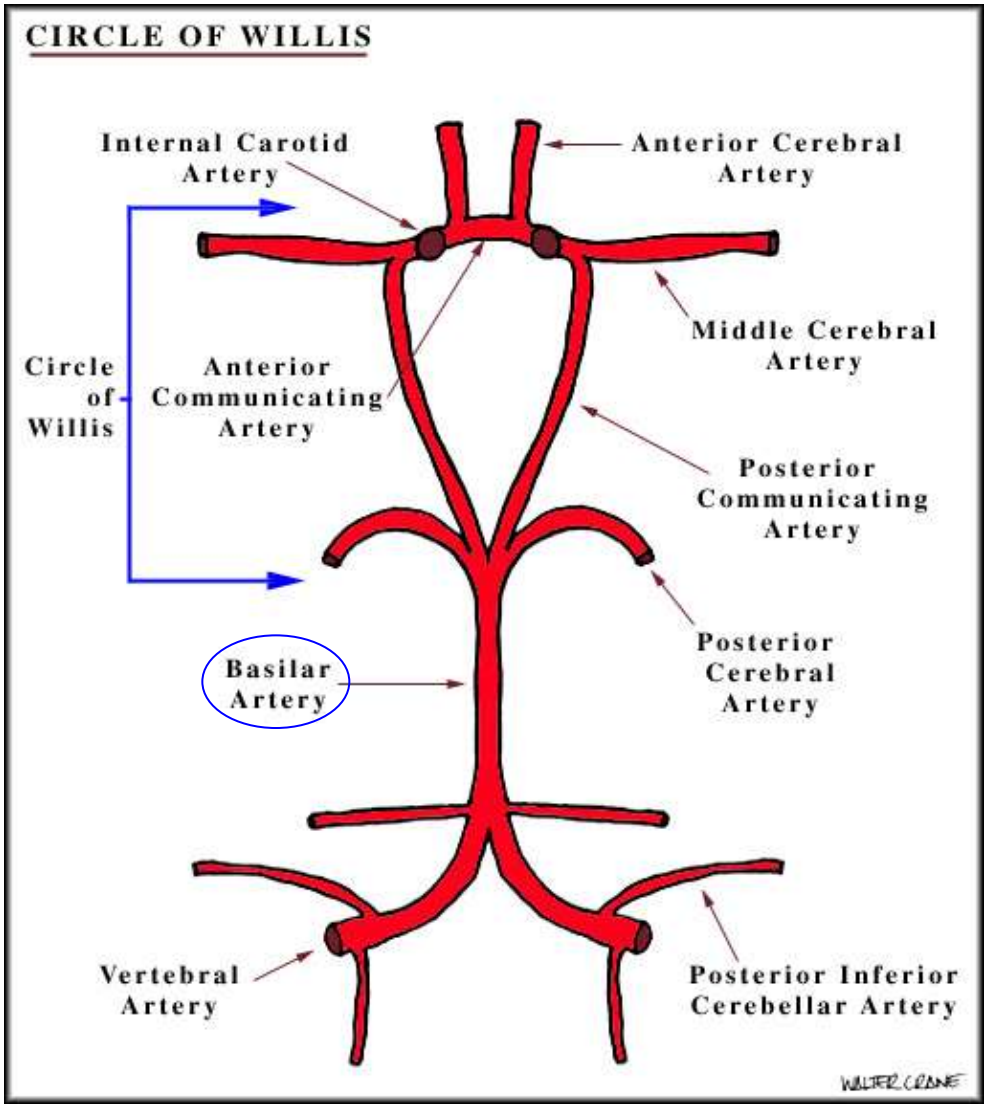


- Contralateral weakness of leg >> arm
- Contralateral hemisensory impairment in the same distribution
- Mood and cognition disturbance:
  - Depression
  - Agitated confusion
  - Emotional lability

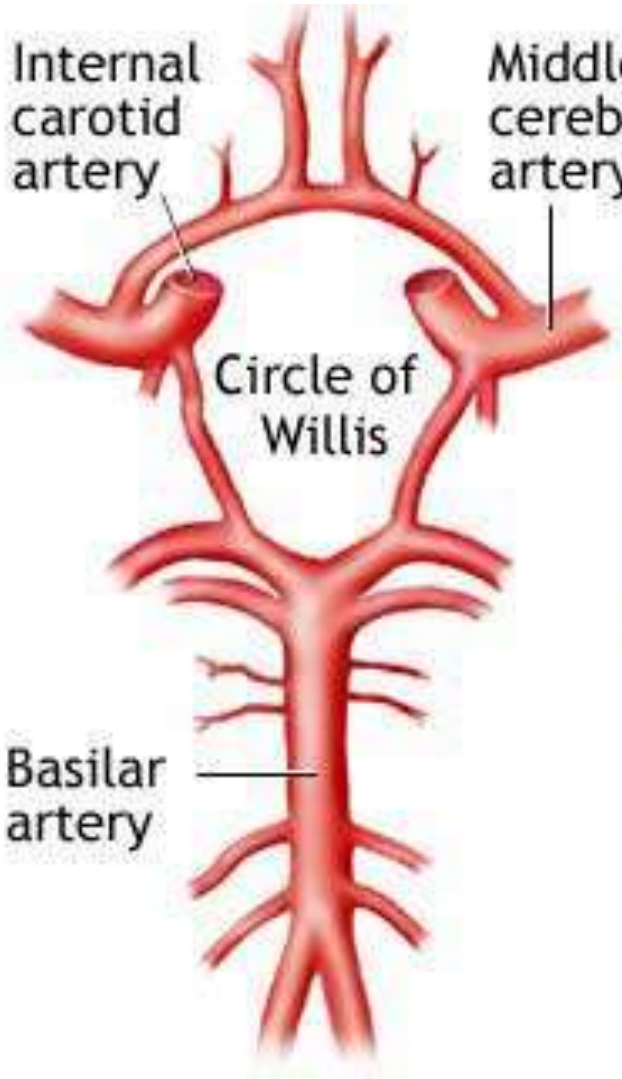
CT showing ACA Territory Infarct

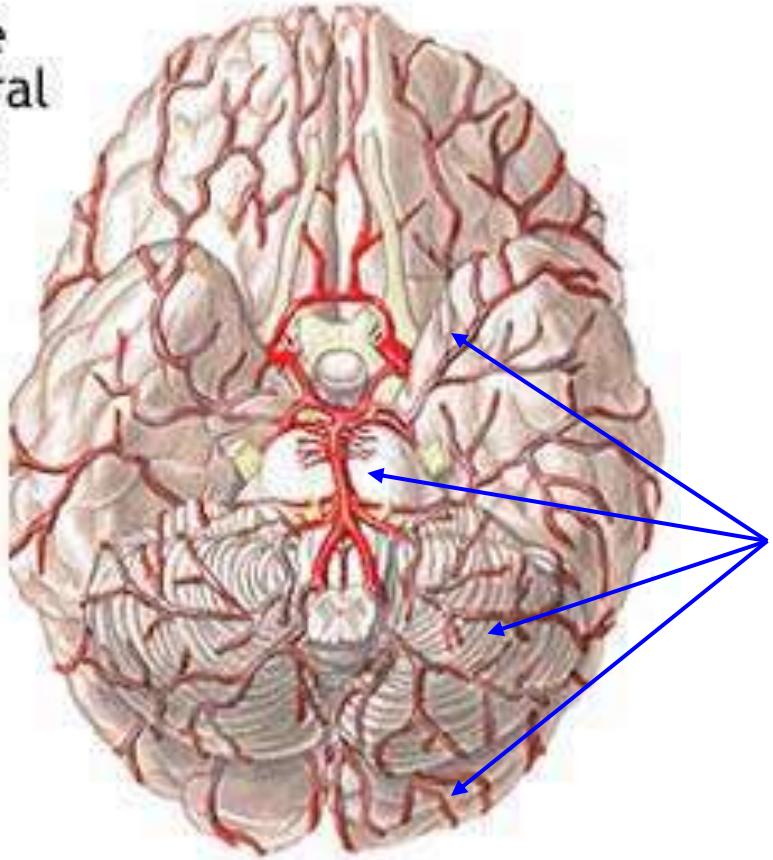
Hypodense area L paramedian frontal lobe

Ischemic Stroke Syndromes
Basilar Artery Occlusion



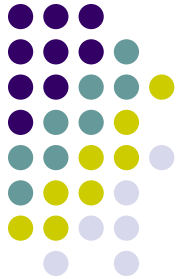
Basilar Artery Anatomy





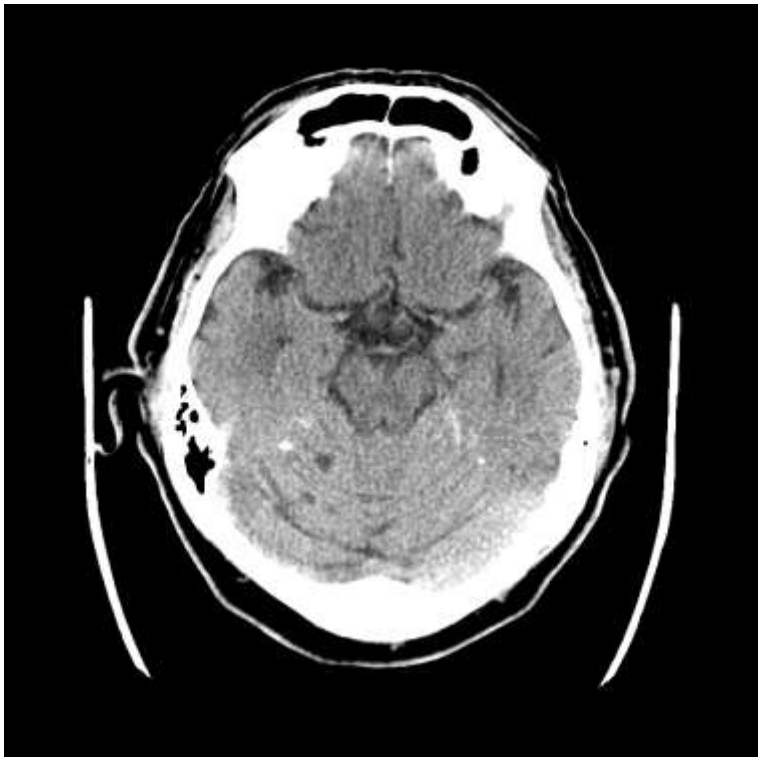
Basilar artery supplies the cerebellum, brainstem, the occipital lobes, medial temporal lobes, and thalami

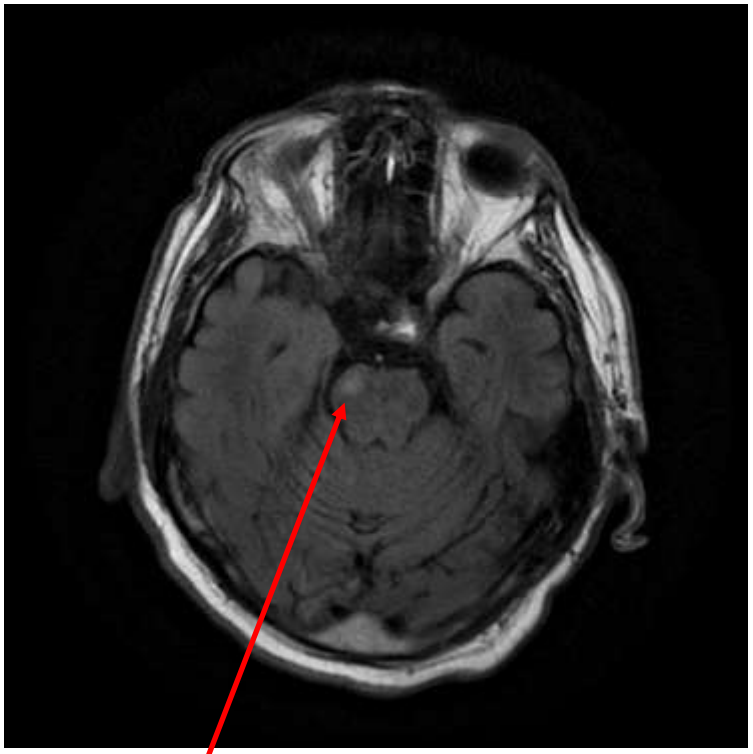
Symptoms associated with Posterior Circulation Strokes



- Slurred speech
- Trouble swallowing
- Double vision
- Vertigo
- Contralateral weakness
- Crossed sensory signs
- Cranial nerve palsies
- Ipsilateral incoordination
- Unsteady gait
- Fluctuating level of consciousness
- Hearing loss

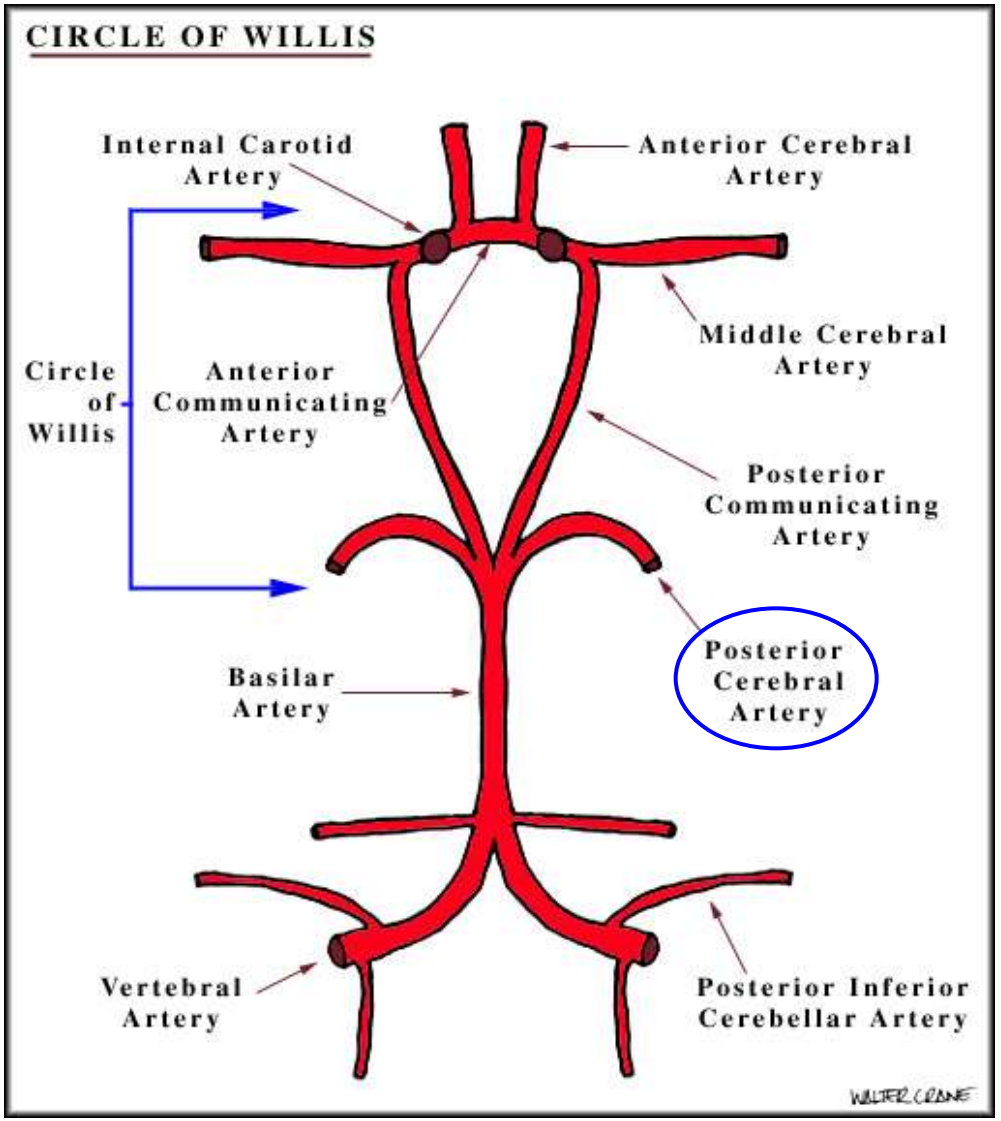
Initial Non-contrast CT Brain often looks Normal



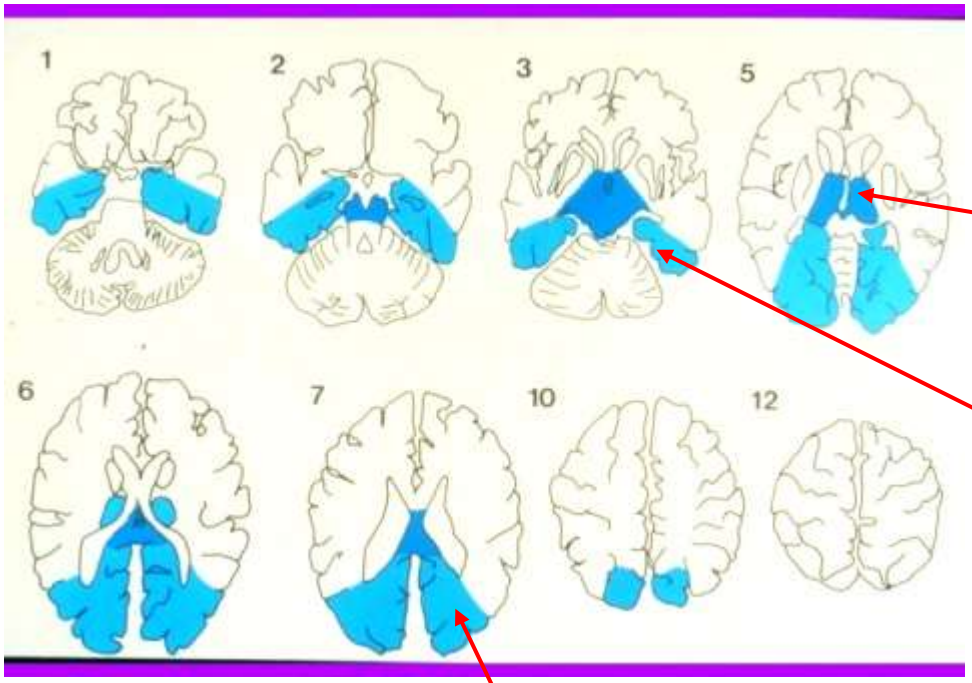


Right pontine stroke on MRI

Ischemic Stroke Syndromes
Posterior Cerebral Artery



PCA



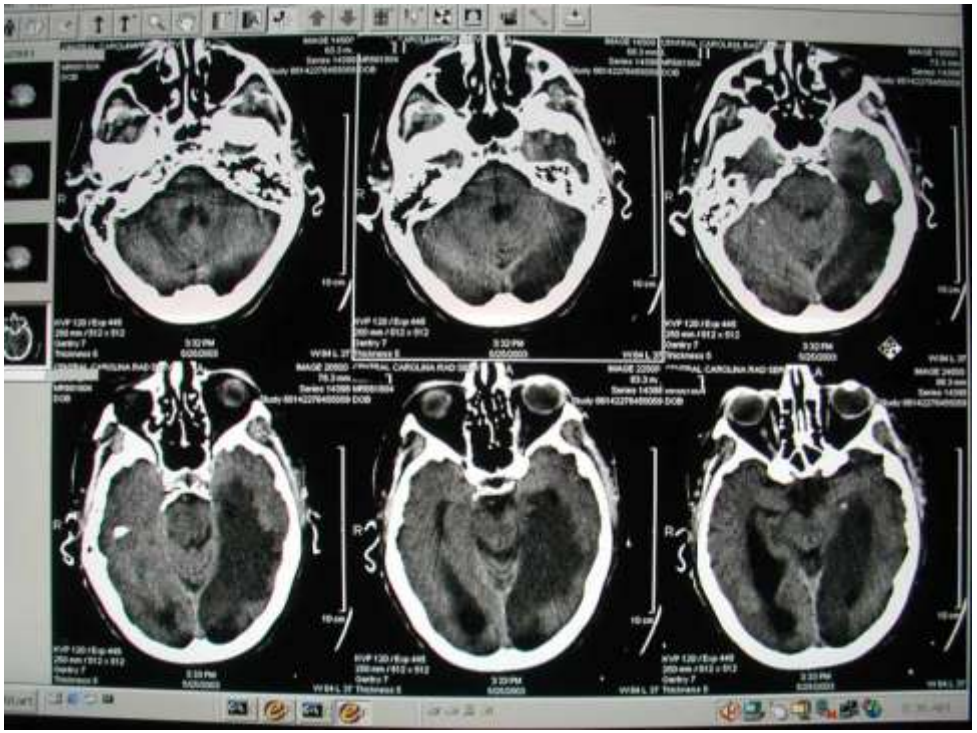
Thalamus

Medial temporal lobe

Occipital lobe

Ischemic Stroke Syndromes Posterior Cerebral Artery

- Contralateral hemianopia
- Confusion and memory disturbance

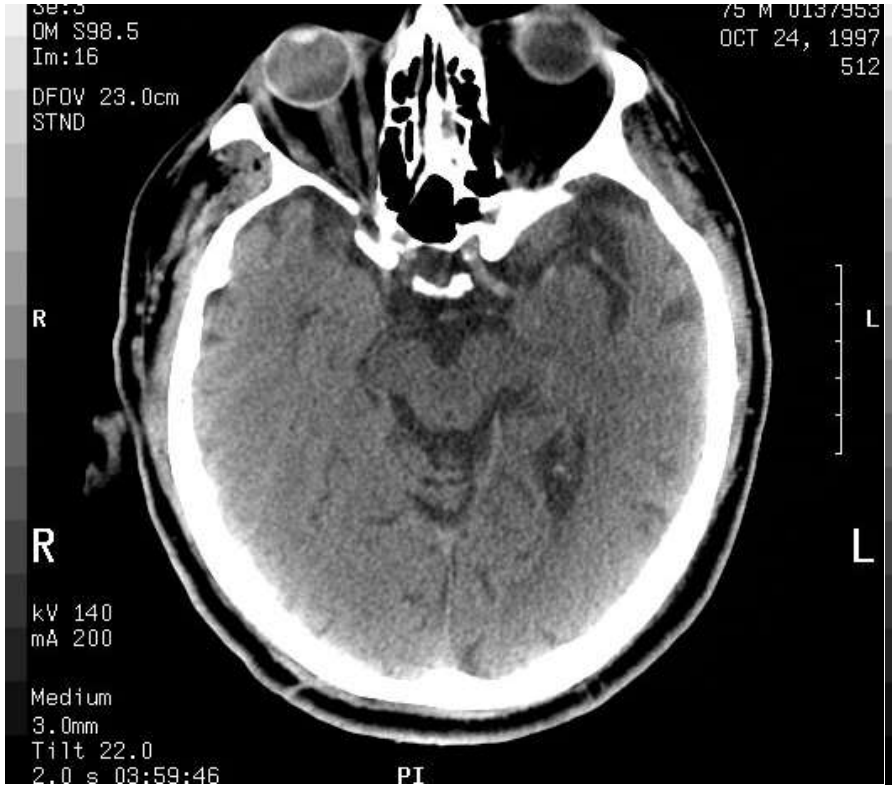


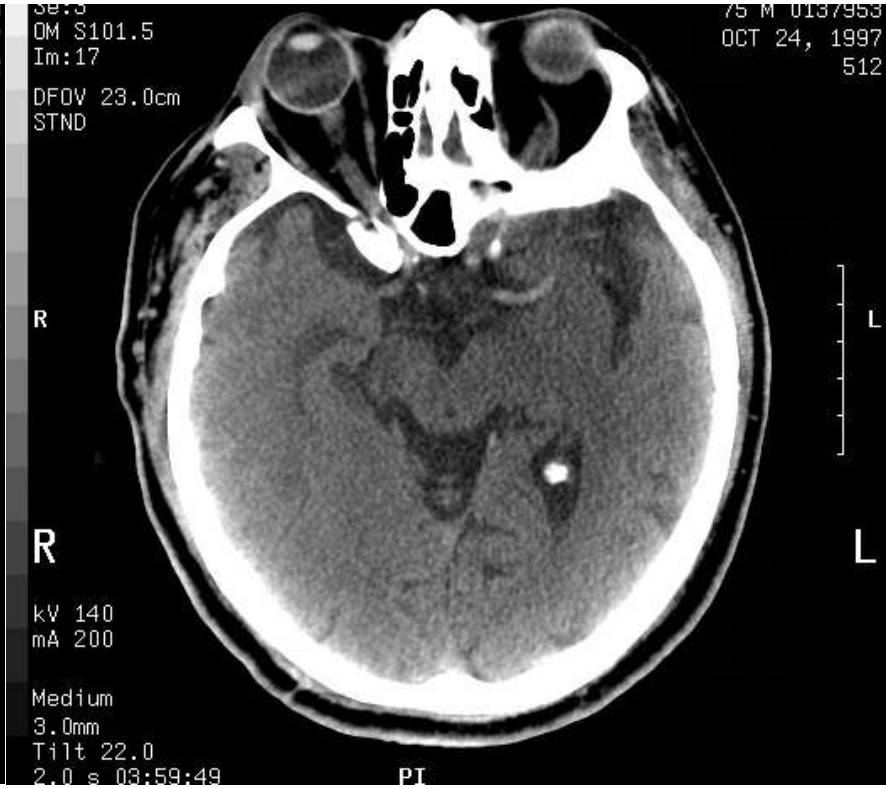
Case Example 1

- 76 yo R handed M
- Sudden onset of
  - Difficulty speaking (non-fluent, unable to read or name)
  - Right weakness (arm>leg)
  - Right sensory impairment
- 90 mins duration
- No headache
- History of CAD / HT / chol
- On aspirin

- Does this presentation conform to a particular stroke syndrome?
- Which hemisphere is affected?

Diagnosis?


OM S98.5
Im:16
DFOV 23.0cm
STND
OCT 24, 1997
512
R
L
R
L
kV 140
mA 200
Medium
3.0mm
Tilt 22.0
PI


OM S101.5
Im:17
DFOV 23.0cm
STND
OCT 24, 1997
512
R
L
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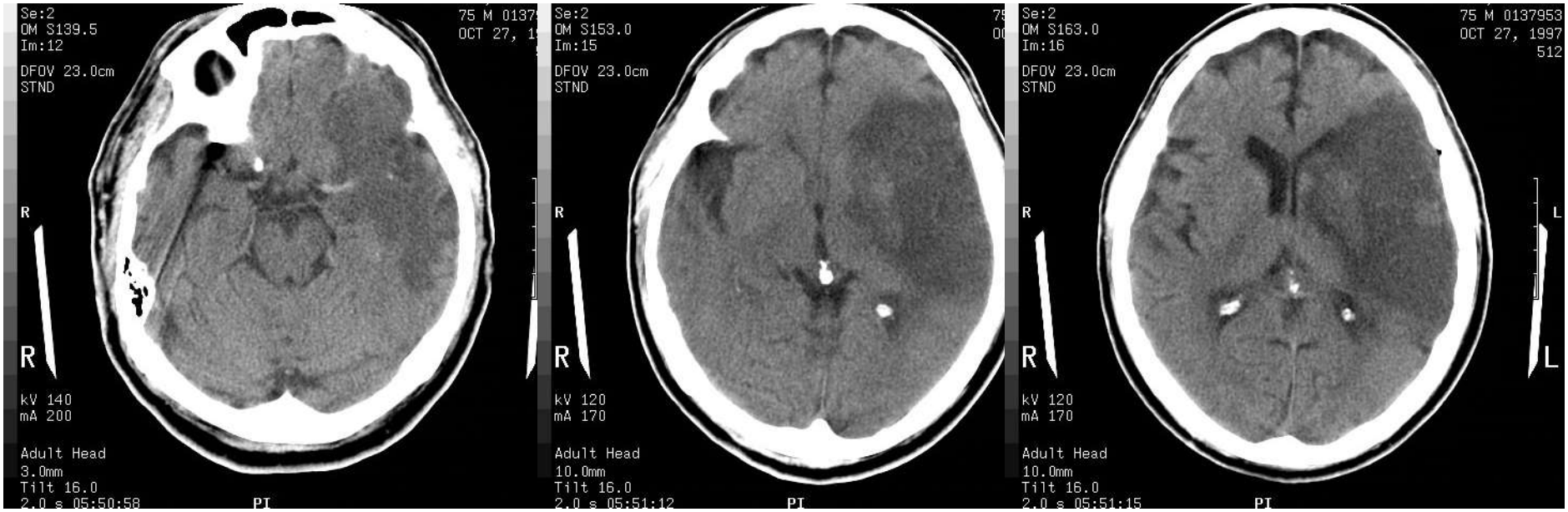
L
kV 140
mA 200
Medium
3.0mm
Tilt 22.0
PI

Follow-up CT's



Case Example 2

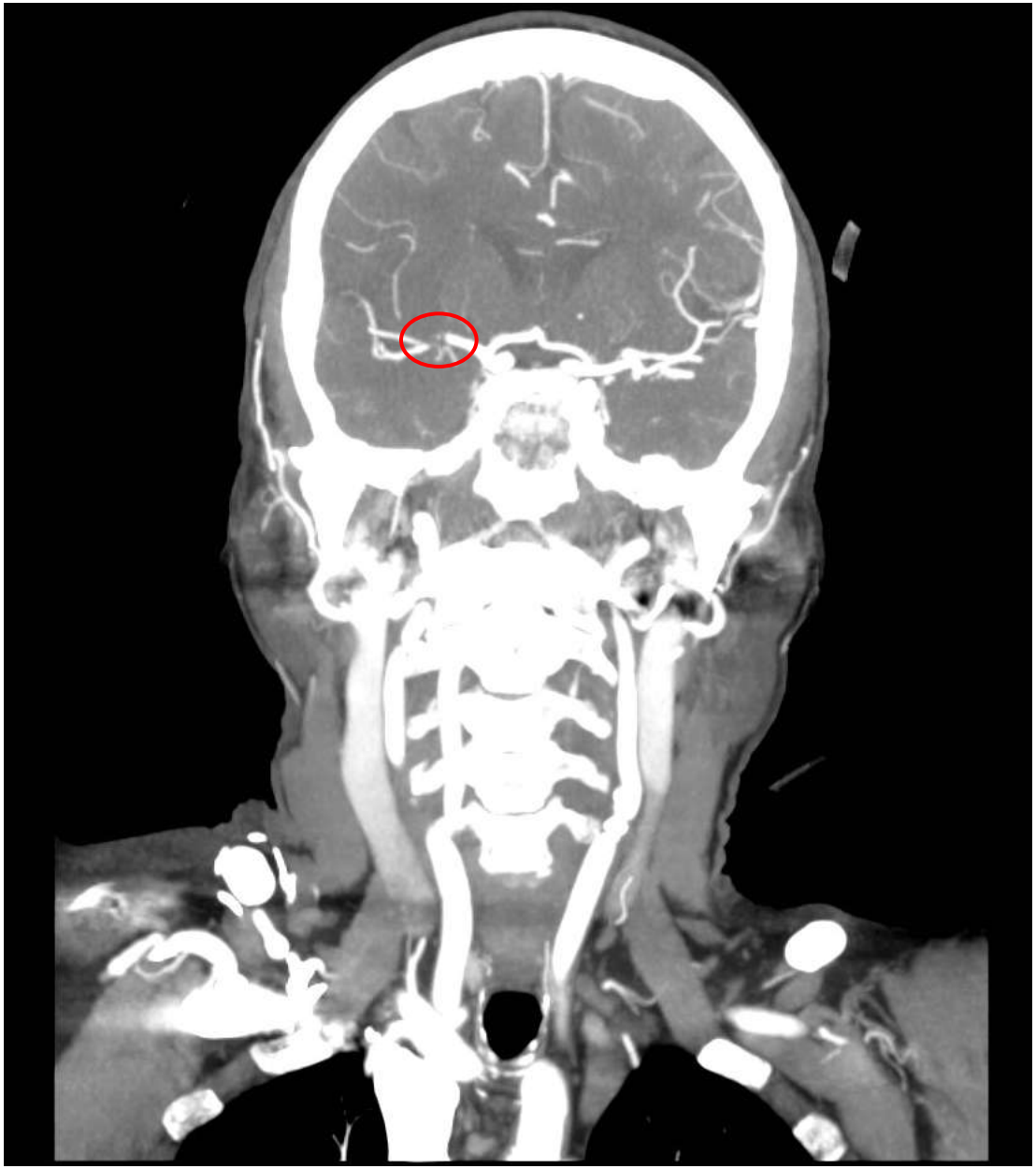
- 79 yo R handed F
- Background: Uncontrolled HT (non-compliant)
- Sudden onset of headache, nausea and vomiting
- Now drowsy with right hemiplegia
- BP 230/105mmHg

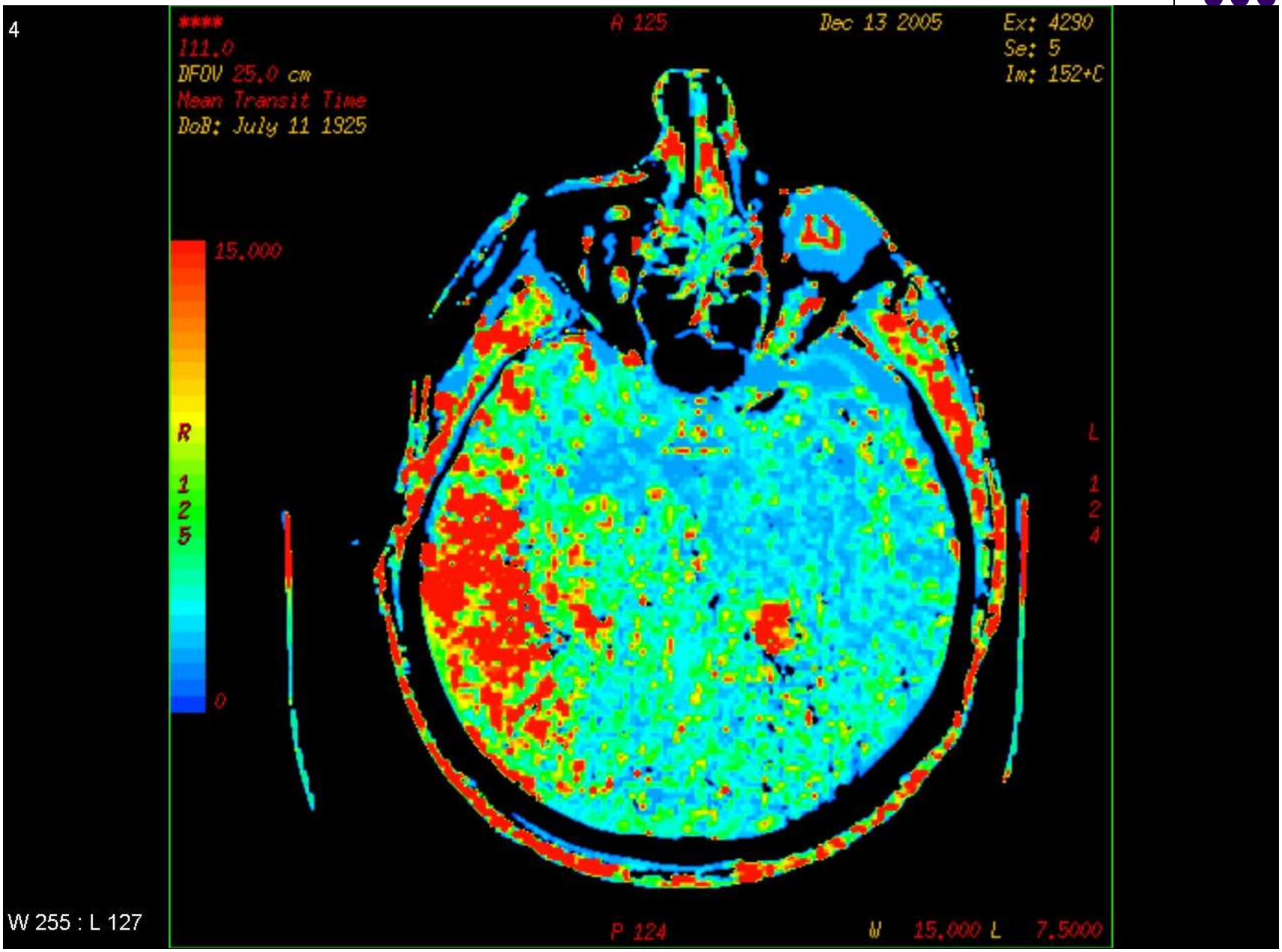
- What do you think the CT will show?
- Where will the lesion be based on clues from the history?

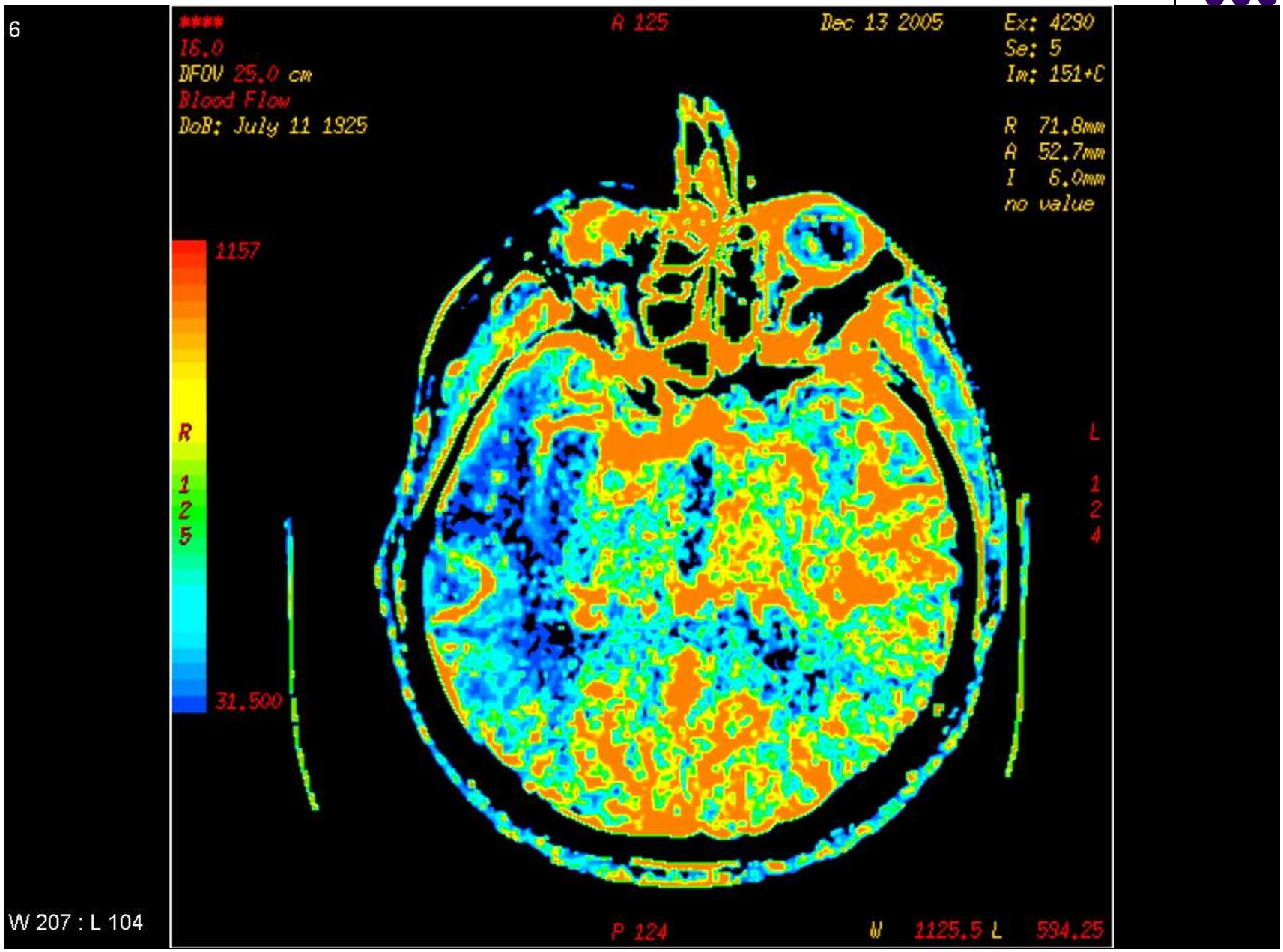
Case Example 3

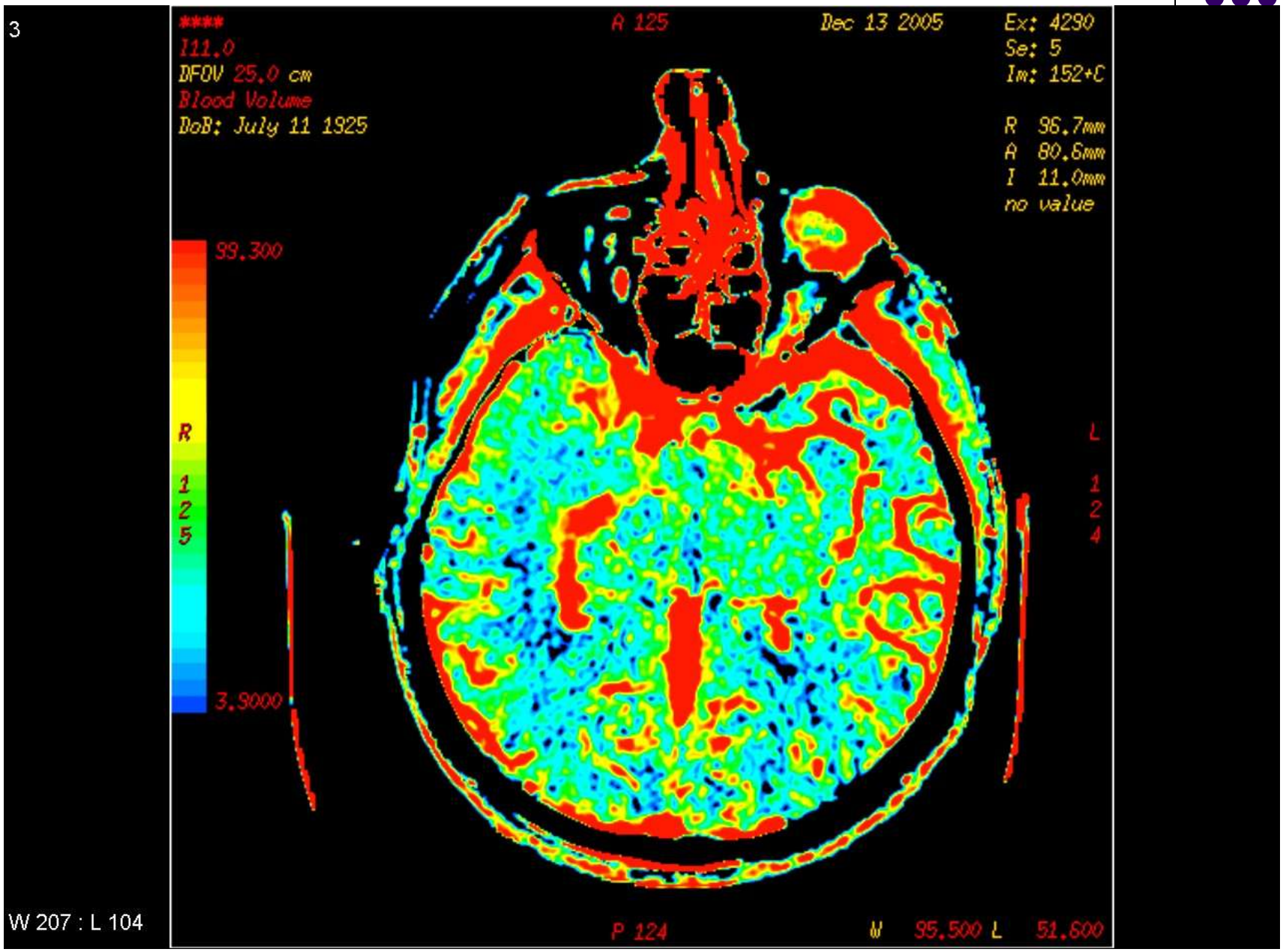
- 80 year old woman
- 1 hour history
  - Acute hemiplegia
  - Gaze deviation
  - Hemispatial neglect
- A fib

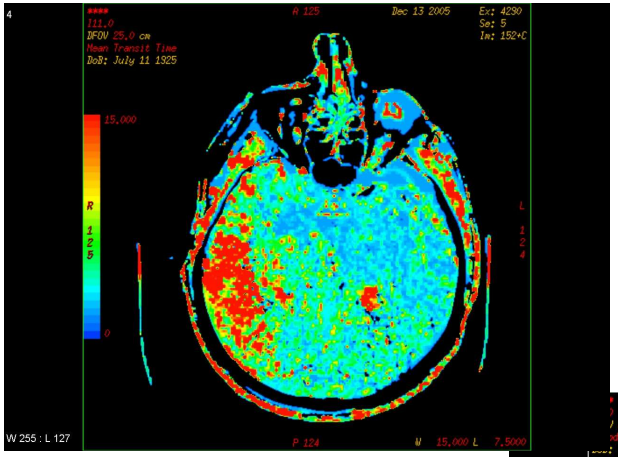

1.3 ACUTE STROKE CTA
PI



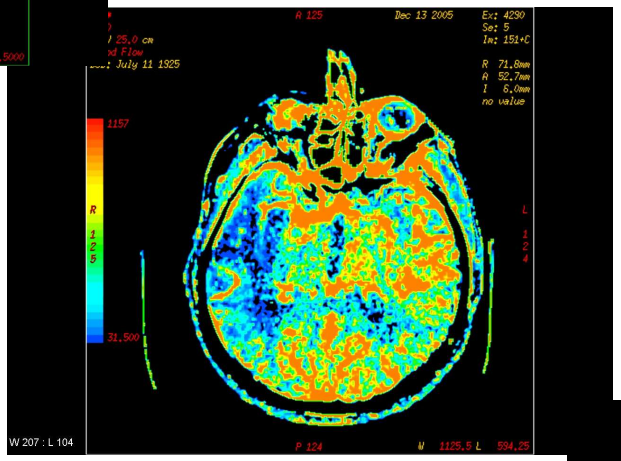

4
****
I11.0
DFOV 25.0 cm
Mean Transit Time
DoB: July 11 1925
A 125
Dec 13 2005
Ex: 4290
Se: 5
Im: 152+C
15.000
R
125
0
L
124
P 124
W 15.000 L 7.5000
W 255 : L 127


6
****
16.0
DFOV 25.0 cm
Blood Flow
DoB: July 11 1925
A 125
Dec 13 2005
Ex: 4290
Se: 5
Im: 151+C
R 71.8mm
A 52.7mm
I 6.0mm
no value
1157
R
125
31.500
L
124
W 207 : L 104
P 124
W 1125.5 L 594.25

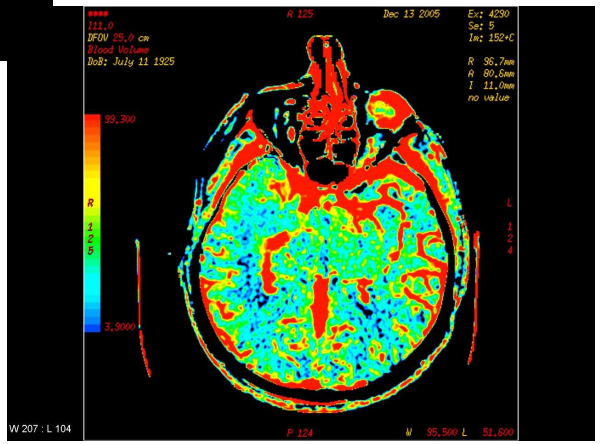

3
****
I11.0
DFOV 25.0 cm
Blood Volume
DoB: July 11 1925
A 125
Dec 13 2005
Ex: 4290
Se: 5
Im: 152+C
R 96.7mm
A 80.6mm
I 11.0mm
no value
99.300
R
125
3.9000
L
124
W 207 : L 104
P 124
W 95.500 L 51.600



Mean transit time prolonged (red)



Cerebral blood flow reduced (blue)

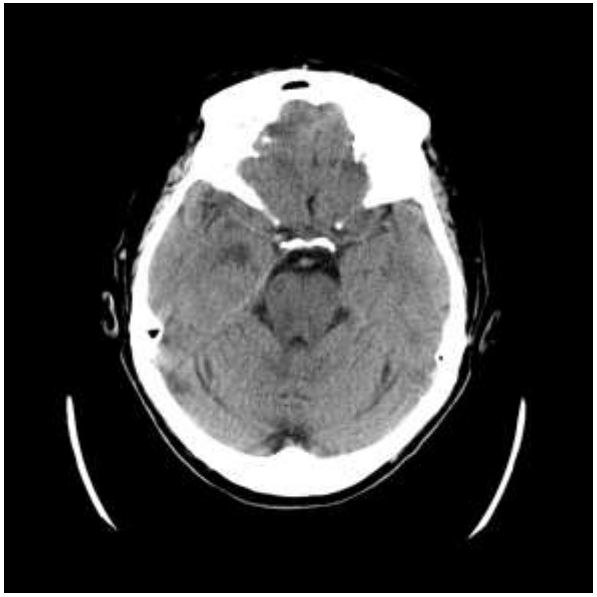
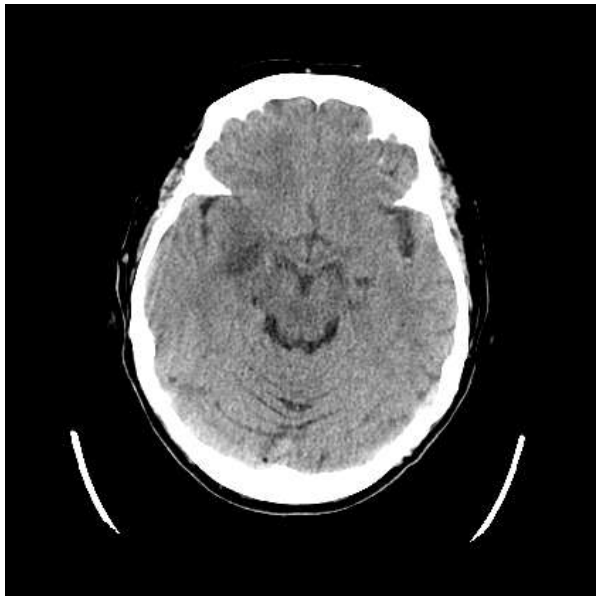
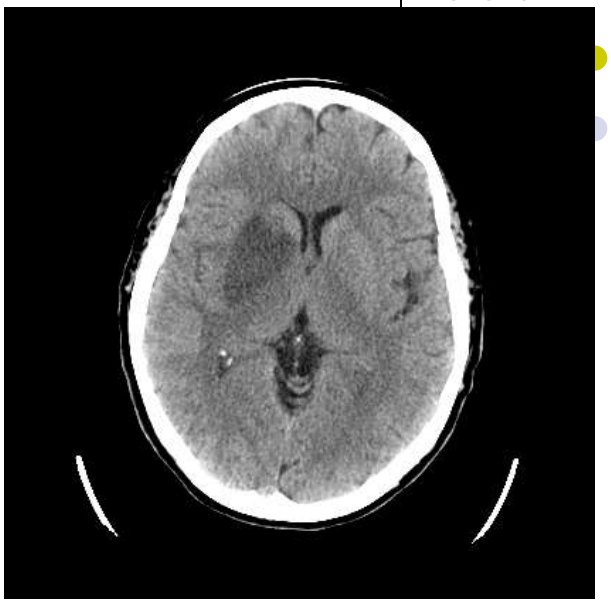
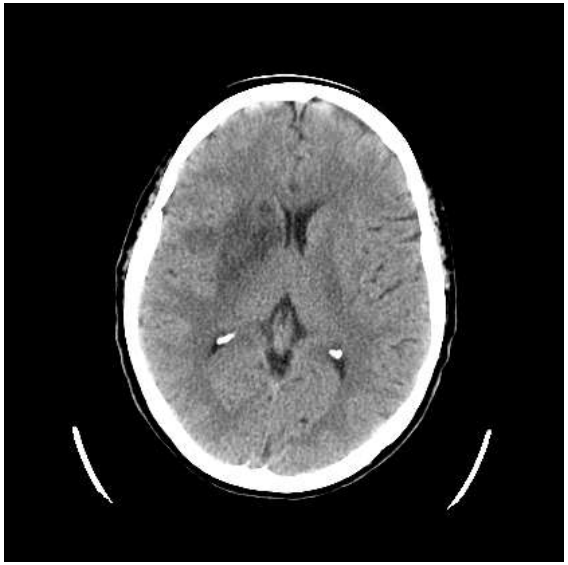
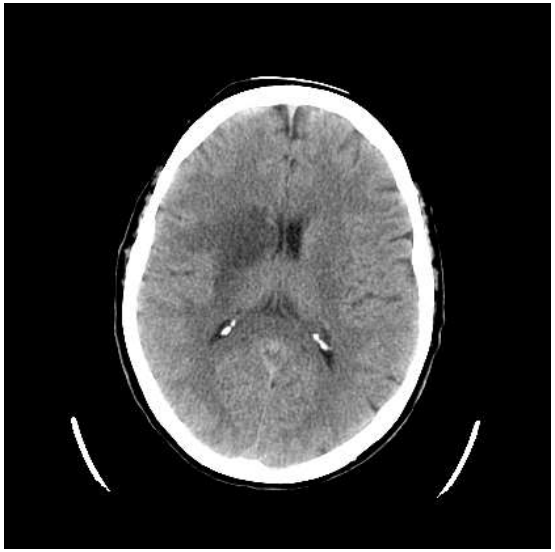


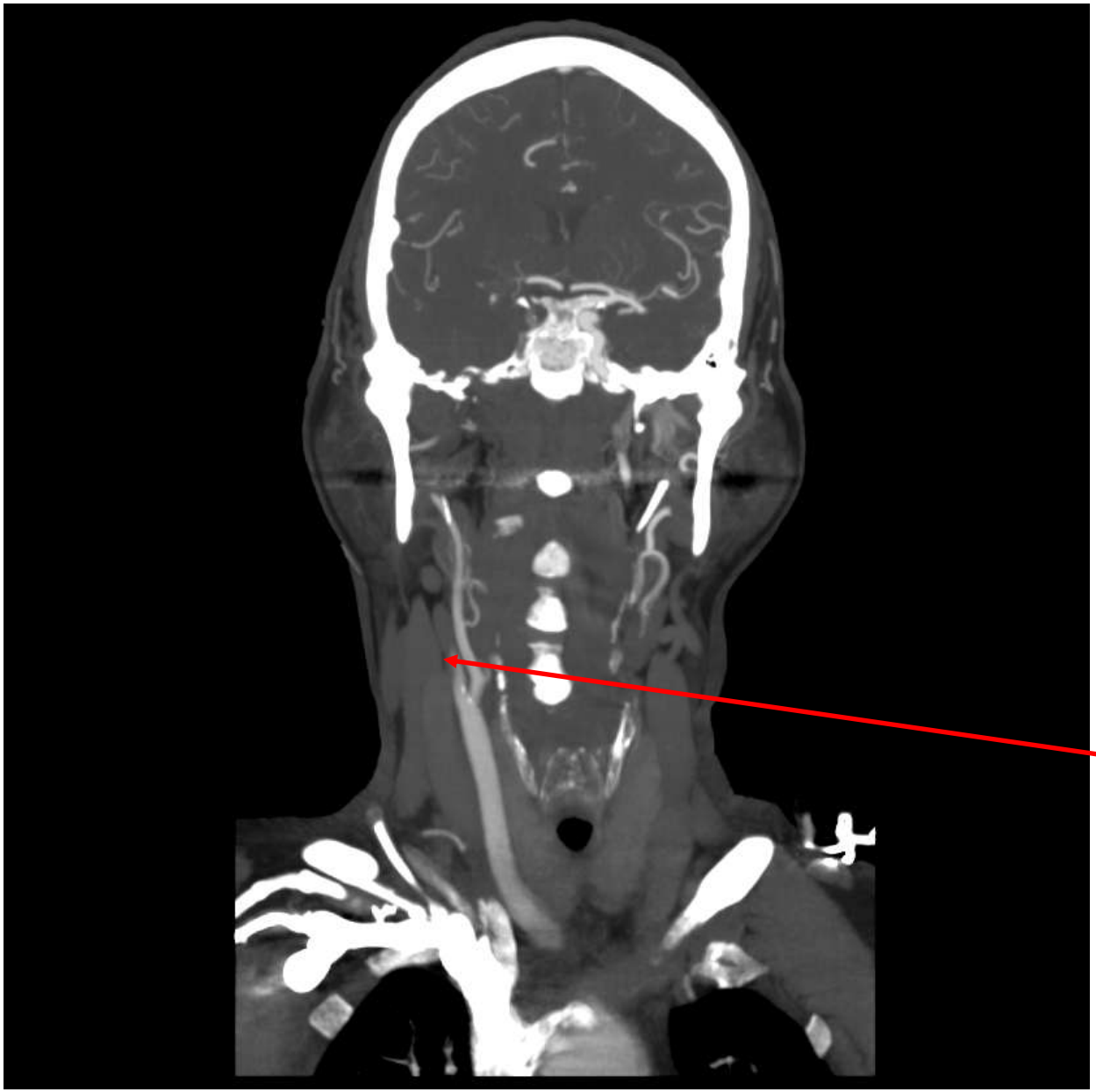
Cerebral blood volume normal

Mismatched defect in the right MCA territory

Case Example 4

- 67 yo R handed female
- Sudden onset 3 hours ago
  - L hemiparesis
  - L hemisensory impairment
  - Dysarthria
- Alert + BP 190/85
- Background of HT / chol

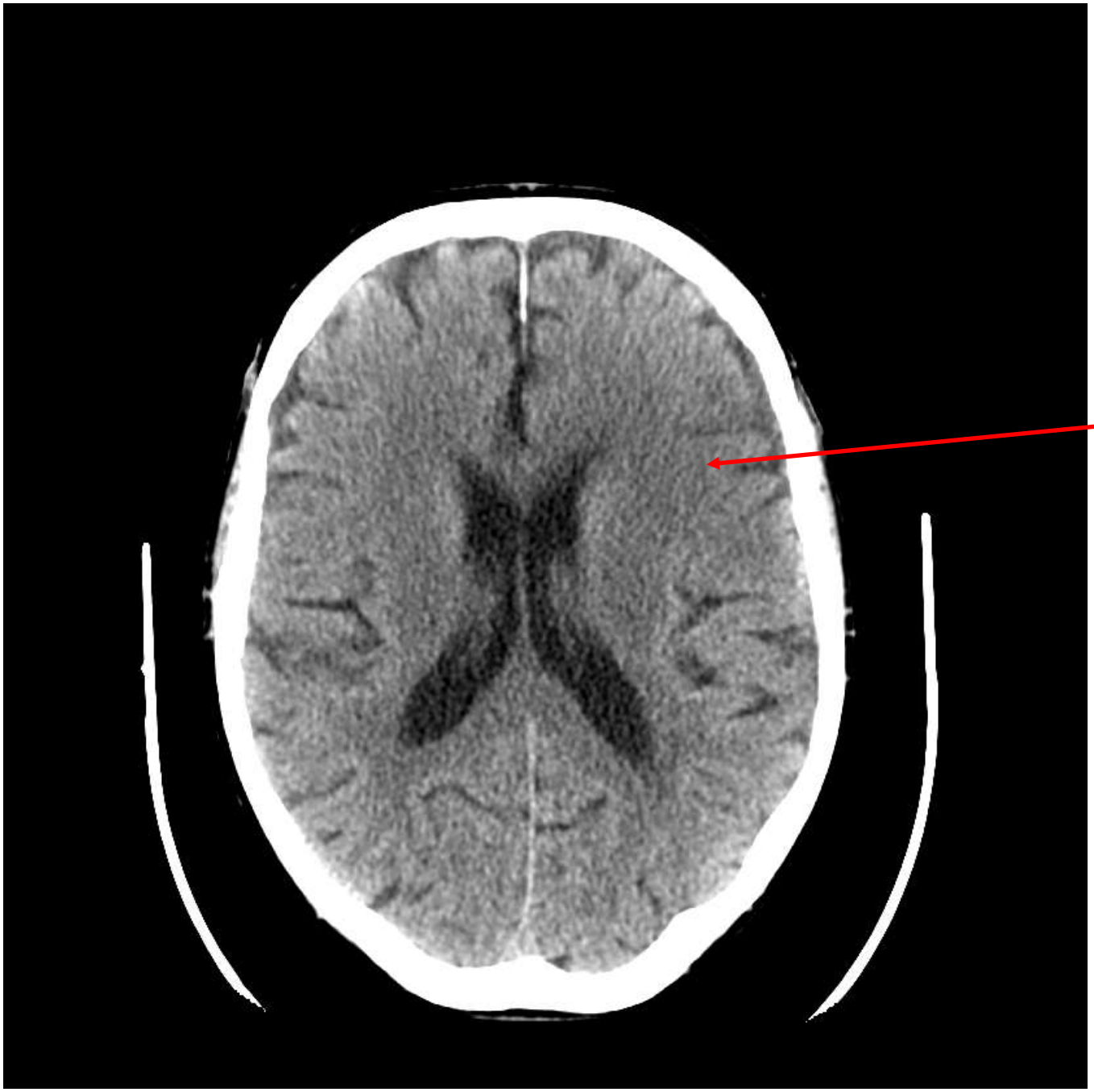








Right internal carotid artery occlusion

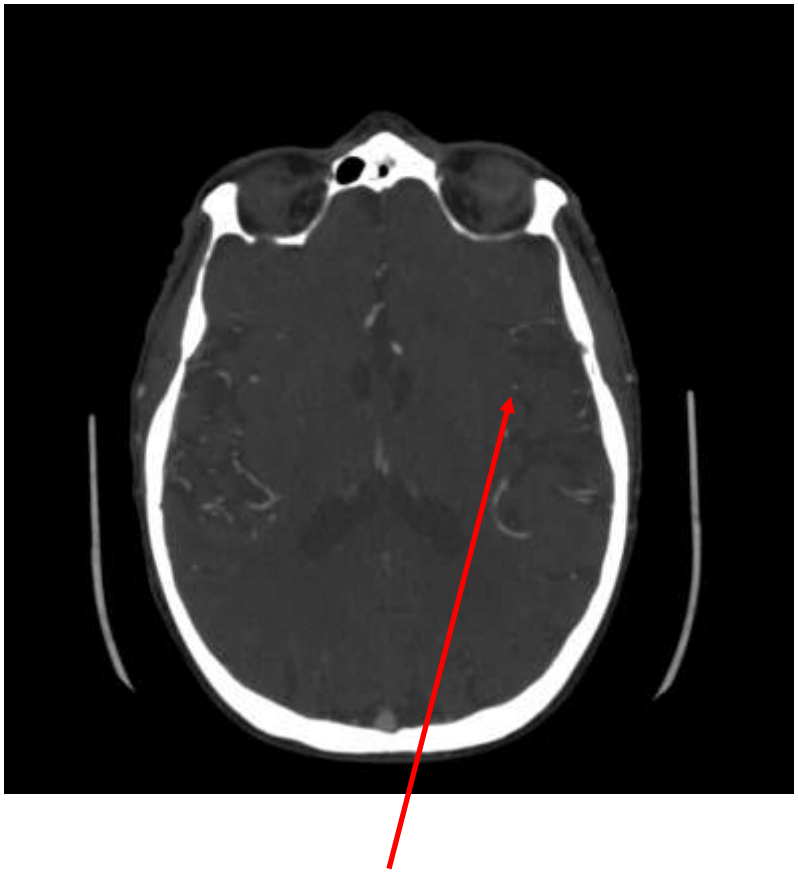
Case Example 5

- 82 yo RH man
- Background of HT and diabetes
- 2 hour history of
  - Non-fluent speech
  - Word-finding difficulty
  - R hemiparesis
- Which blood vessel is involved?
- Which hemisphere?
- Management?

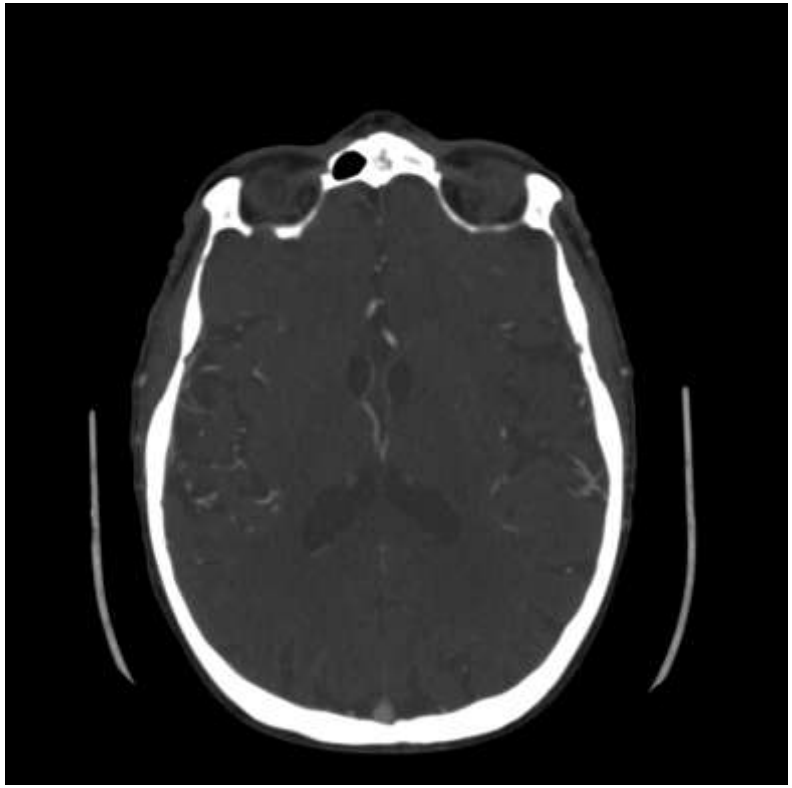


Subtle loss of grey-white differentiation in L frontal region

CT Angiogram

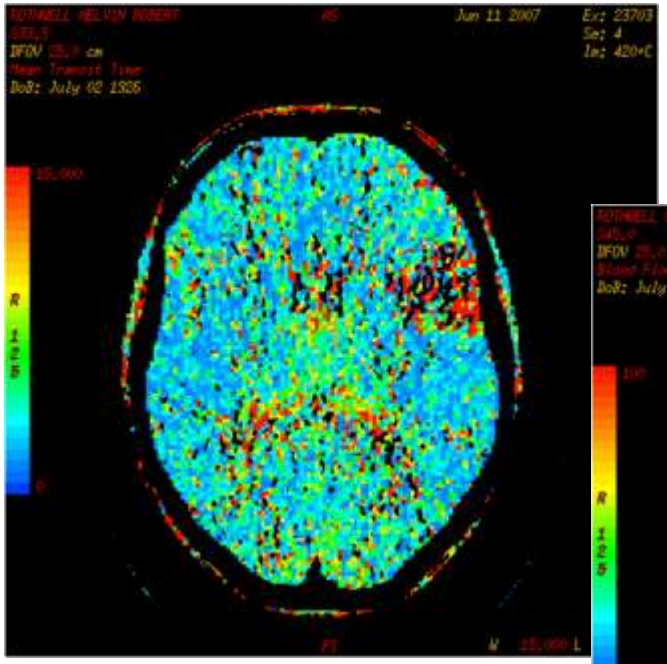


Occluded 2nd branch
of L MCA

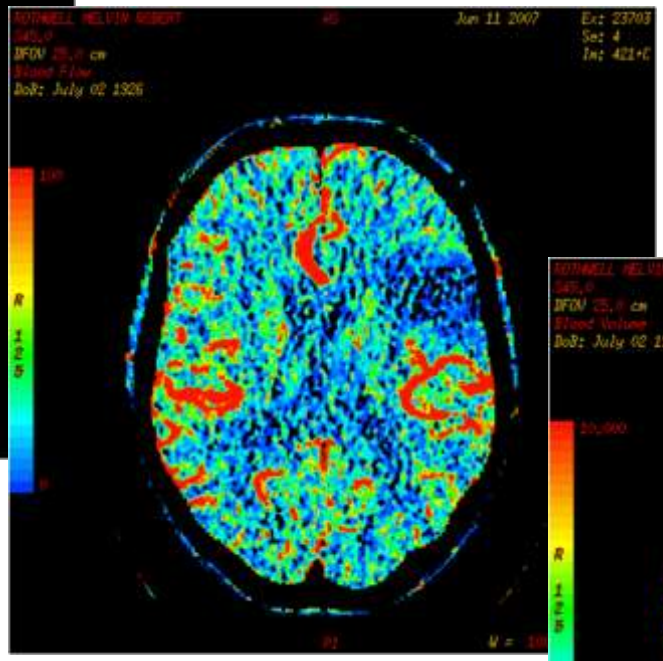


Reduced collateral branches

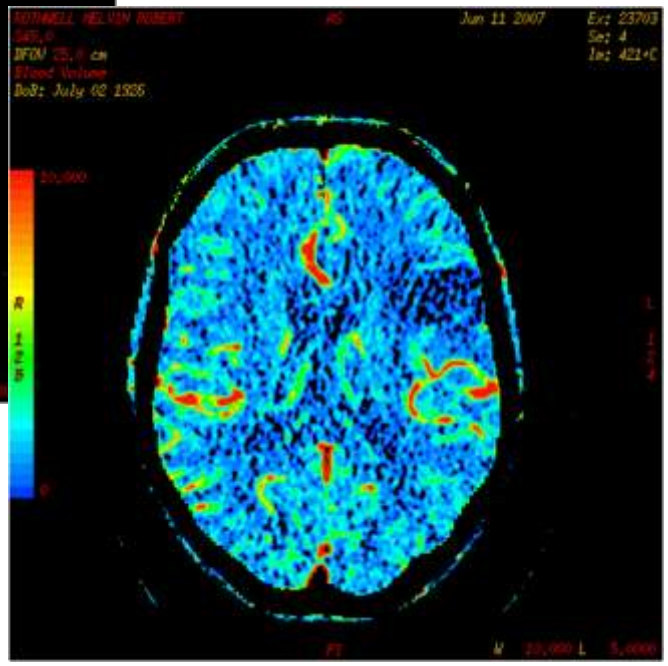
In L MCA territory



Prolonged mean transit time (red)



Reduced cerebral blood flow (blue)



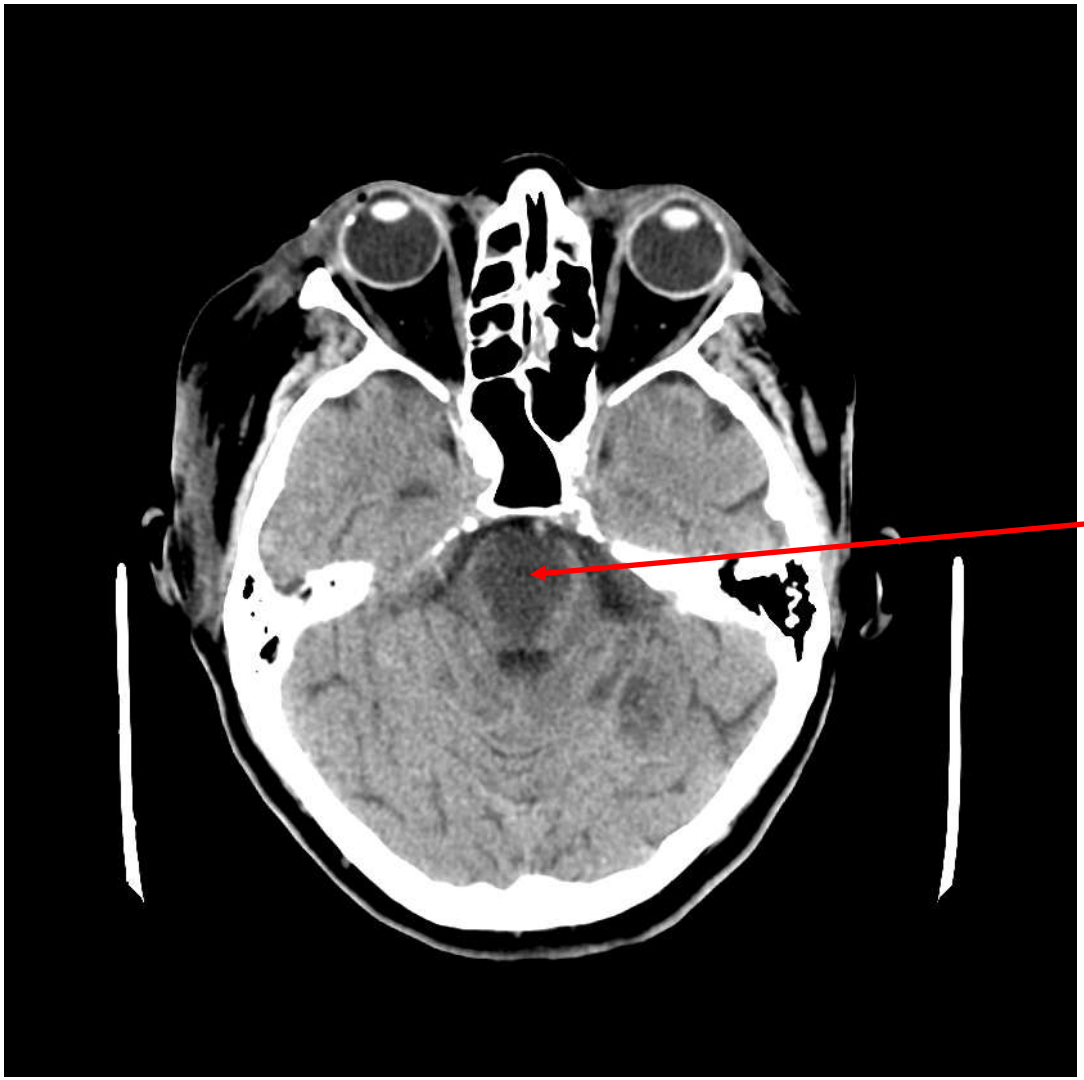
Reduced cerebral blood volume (blue)

Matched defect in the left MCA territory

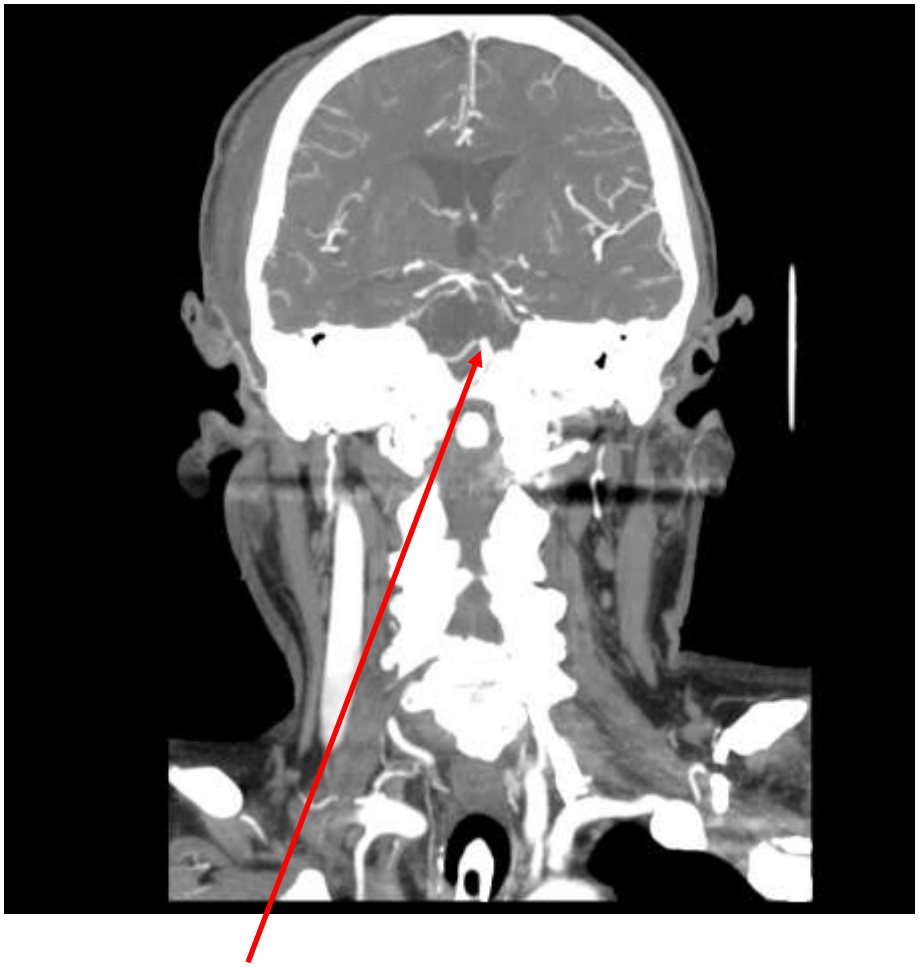
Case Example 6

- 76 yo F
- Found collapsed
- Unresponsive
- Spastic quadriplegia
- No verbal output
- No gag reflex
- No facial movement
- Able to respond by blinking or with vertical eye movements

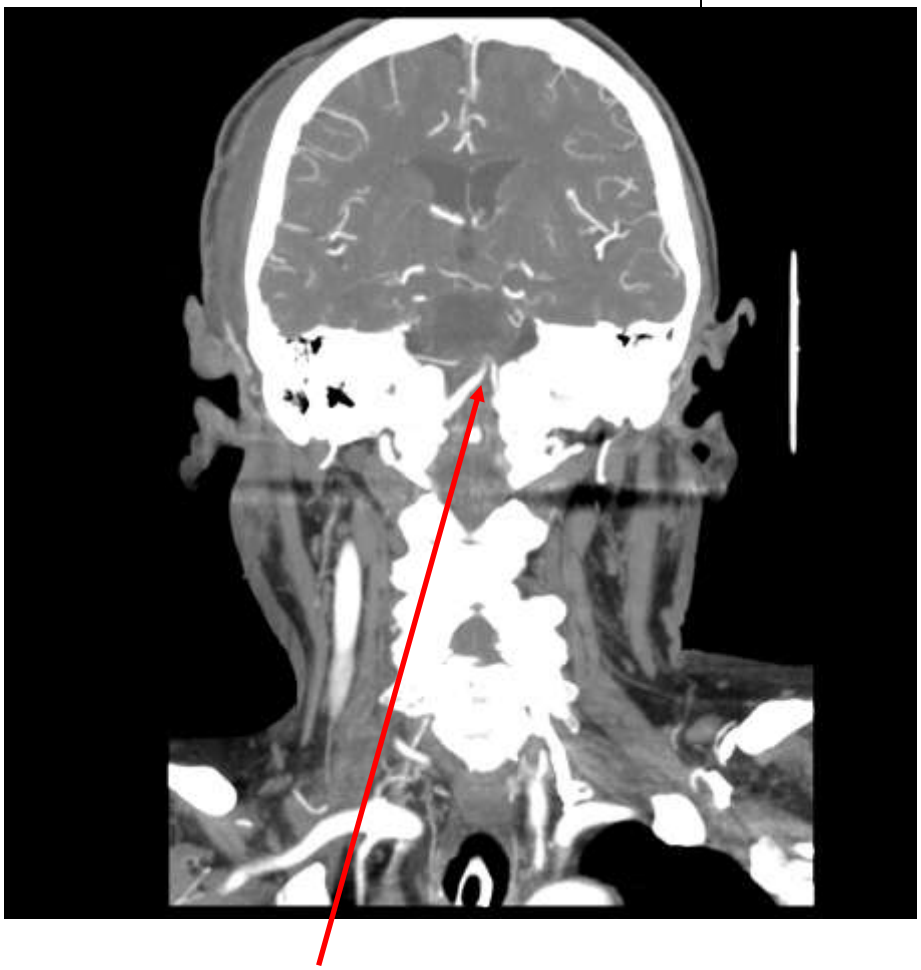
Non-Contrast CT Brain Scan



CT Angiogram



Occluded basilar artery



2 vertebral arteries join to become the basilar artery