PSFDH Stroke Update

September 19, 2024

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Disclosures

- I have no conflicts of interest to declare.

Objectives

- Paramedic and triage screening tools affect the treatment of stroke patients from Perth and Smiths Falls
- History, examination, and a simple (?) way to read a CT head
- Stroke syndromes and stroke mimics
- TIA management and stroke complications in the ED

Brockville, Thrombolysis, and Telestroke

- July 8, 2024: Brockville General Hospital joined the provincial Telestroke network to treat acute ischemic stroke patients with thrombolysis using TNK

- This is coordinated with Lanark EMS, Leeds and Grenville EMS, Ontario Health, Stroke Network of Southeastern Ontario, and Champlain Regional Stroke Network

Pre-Hospital Options for PSFDH

- Emergency Medical Services in Lanark, and Leeds and Grenville Counties rely on the **time last known well (LKW)** and the **Los Angeles Motor Scale (LAMS)** screening tool to determine if the patient should be brought directly to an EVT-capable hospital (i.e. either TOH-Civic or KHSC-KGH), or to Brockville General Hospital for thrombolysis, or to PSFDH for further assessment

- The LAMS tool can help identify patients who are likely to have **large vessel occlusion (LVO)**

The Los Angeles Motor Scale

FACIAL DROOP
ABSENT: 0
PRESENT: 1

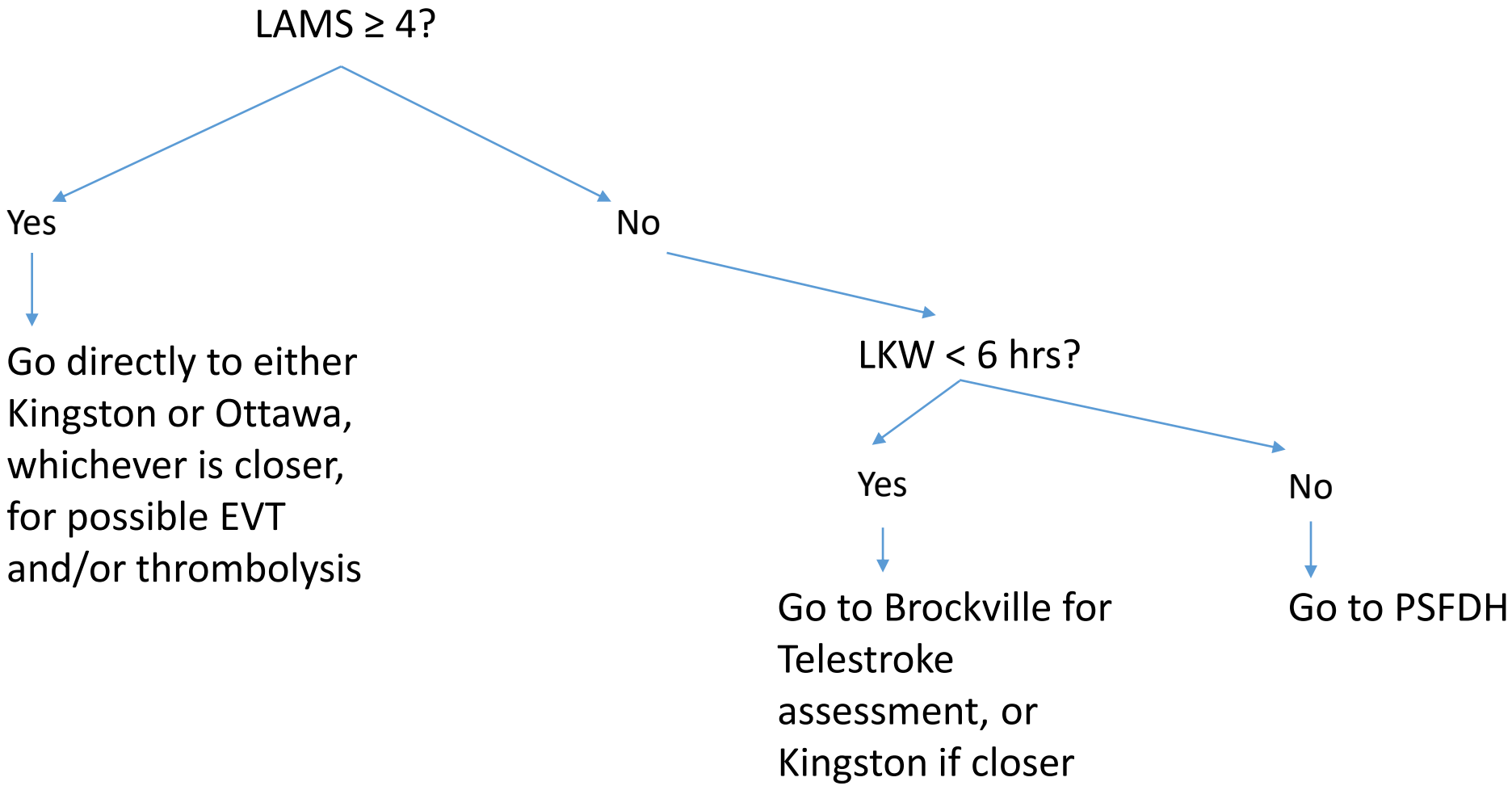
ARM DRIFT
ABSENT: 0
DRIFTS DOWN: 1
FALLS RAPIDLY: 2

GRIP STRENGTH
NORMAL: 0
WEAK GRIP: 1
NO GRIP: 2

LAMS Score ≥4 indicates a more severe stroke and can be communicated as LVO screen positive

Adapted from *The Paramedic Prompt Card for Acute Stroke Bypass Protocol - Paramedic Training Module* originally developed by CorHealth Ontario https://www.youtube.com/watch?v=EanfEzCHYc8&feature=youtu.be

LAMS and Last Known Well (LKW) < 24 hrs



Walk-In Options for PSFDH

- No changes to current protocols in PSFDH for walk-in patients
- As before, ACT-FAST is the main screening tool used by triage to assess possibility for large vessel occlusion (LVO)

Rapid ED screen for Large Vessel Occlusion (LVO) using ACT-FAST

CLINICAL AND POPULATION SCIENCES

Utility of Severity-Based Prehospital Triage for Endovascular Thrombectomy

ACT-FAST Validation Study

Henry Zhao, MBBS; Karen Smith, PhD; Stephen Bernard, PhD; Michael Stephenson, BHlthSc; Henry Ma, PhD; Ronil V. Chandra, MMed; Thanh Phan, PhD; Christopher F. Bladin, PhD; Leonid Churilov, PhD; Douglas Crompton, PhD; Helen M. Dewey, PhD; Tissa Wijeratne, MD; Geoffrey Cloud, MBBS; Vincent Thijs, PhD; Timothy J. Kleinig, PhD; Jo Lyn Ng, MBBS; Cameron Williams, MBBS; Fana Alemseged, MD; Felix Ng, MBBS; Peter J. Mitchell, MMed; Mark W. Parsons, PhD; Nawaf Yassi, PhD; Stephen M. Davis, MD; Bruce C.V. Campbell, PhD

Stroke. 2021;52:70–79. DOI: 10.1161/STROKEAHA.120.031467

ACT-FAST Stroke Algorithm (Simplified)

Step 1

Yes

ARM – only one arm completely falls to stretcher <10 secs when positioned at 45 degrees from horizontal

Step 2

Yes

CHAT – if right arm weak -> severe language deficit, OR

TAP – if left arm weak -> obvious gaze away from weak side or ignores examiner after shoulder tap on weak side

Step 3

Yes

ACT-FAST POSITIVE

Eligibility screen

- < 24hrs onset
- Independent at home with minimal assistance
- Exclude mimics – BSL, seizure, coma, brain cancer
- No rapid spontaneous improvement at scene of attendance

If NO at any step – patient is ACT-FAST negative

TRIAGE TOOLs for Acute Stroke <24 hours

Adapted from Toronto Stroke Network & Ambulance Clinical Triage for Acute Stroke Treatment" Zhao et al. Stroke 2018;49:945-951

STROKE NETWORK *of* Southeastern Ontario

Kingston Health Sciences Centre

Centre des sciences de la santé de Kingston

FAST Stroke Screen:

FACE is it drooping?

OR

ARM can raise both arms?

OR

SPEECH is it slurred or jumbled?

AND

TIME is it less than 24 hours?

- ✓ One or more symptoms from Face, Arm, Speech **AND**
- ✓ LAST SEEN NORMAL <24 hours

IF ≤ 6 hours, Call Switchboard to Activate Acute Stroke Protocol

IF 6 -24 hours, Complete **ACT-FAST**

ACT-FAST Stroke Screen:

"ARM" (one-sided arm weakness)

Position both arms at 45^0 from horizontal with elbows straight

POSITIVE TEST : One arm falls completely within 10 seconds

For patients that are uncooperative or cannot follow commands:

POSITIVE TEST:

Witness minimal or no movements in one arm & movements in other arm

Proceed if Positive

If **RIGHT** ARM is weak

"CHAT" (Severe language deficit)

POSITIVE TEST: Mute, speaking incomprehensible, or unable to follow simple commands

If **LEFT** ARM is weak

"TAP" (gaze & shoulder tap)

Stand on patient's weak side

POSITIVE TEST : Consistent eye gaze away from weak side

Otherwise

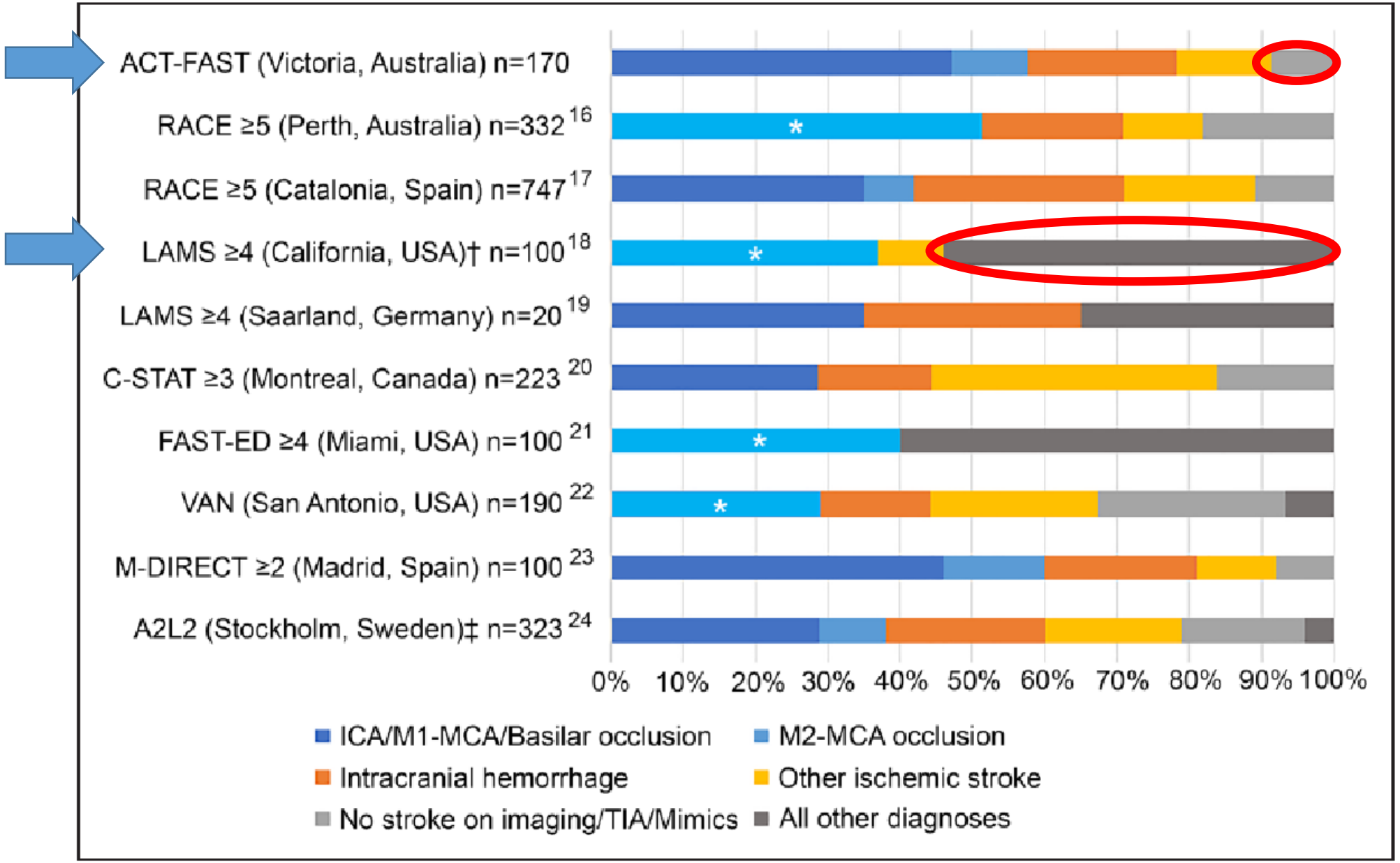
Tap shoulder & call name

POSITIVE TEST : Does not quickly turn head & eyes to you

Proceed if Positive

Call Switchboard to Activate Acute Stroke Protocol

2019-02-07



Stroke. 2021;52:70–79. DOI: 10.1161/STROKEAHA.120.031467

ED Stroke Examination with the NIHSS

- Focused neurological exam:
  - Can use the NIHSS to structure your neuro exam
    - Don’t worry if you miss an item on the NIHSS

Examination in 3 minutes

- **NIH Stroke Scale**
- *Consciousness*
- *Gaze, Visual Fields, Face*

↓

- *Arm & leg: weak, clumsy, numb*

↓

- *Language*
- *Dysarthria*
- *Inattention*

Start at head

↓

Move to arms and legs

↓

Back up to the head

The main point of the exam is to determine if the deficits are disabling or not

The actual NIHSS score is not as important.

Deficits can be disabling even if the NIHSS is low.

NIHSS

1a. Level of Consciousness (LOC)*

0 = Alert (keenly responsive)
1 = Not alert but arousable by minor stimulation
2 = Not alert: requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements
3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, and flexic

1b. LOC Questions*

Ask the patient: "What month is it? How old are you?"
0 = Answers both correctly
1 = Answers one correctly
2 = Answers neither correctly

1c. LOC Commands*

Command the patient to: "Open and close your eyes. Grip and release your hand."
0 = Performs both correctly
1 = Performs one correctly
2 = Performs neither correctly

2. Best Gaze*

Establish eye contact and ask the patient to: "Follow my finger."

0 = Normal
1 = Partial gaze palsy
2 = Forced deviation or total gaze paresis

3. Visual Fields*

Use confrontation, finger counting, or visual threat.
Confront upper/lower quadrants of visual field.

0 = No visual loss
1 = Partial hemianopsia
2 = Complete hemianopsia
3 = Bilateral hemianopsia

4. Facial Palsy*

By words or pantomime, encourage the patient to: "Show me your teeth. Raise your eyebrows. Close your eyes."

0 = Normal symmetrical movement
1 = Minor paralysis (flattened nasolabial fold, asymmetry on smiling)
2 = Partial paralysis (lower face)
3 = Complete paralysis

5. Arm Motor*

Alternately position patient's arms. Extend each arm with palms down (90° if sitting, 45° if supine).

0 = No drift 1 = Drift
2 = Some effort vs gravity
3 = No effort vs gravity
4 = No movement

6. Leg Motor*

Alternately position patient's legs.
Extend each leg (30°, always while supine).

0 = No drift 1 = Drift
2 = Some effort vs gravity
3 = No effort vs gravity
4 = No movement

7. Limb Ataxia*

Ask patient (eyes open) to: "Touch your finger to your nose. Touch your heel to your shin."

0 = Absent
1 = Present in one limb
2 = Present in two or more limbs

8. Sensory*

Test as many body parts as possible (arms [not hands], legs, trunk, face) for sensation using pinprick or noxious stimulus (in the obtunded or aphasic patient).

0 = Normal
1 = Mild-to-moderate sensory loss
2 = Severe-to-total sensory loss

9. Best Language*

Using pictures and a sentence list (see reverse), ask the patient to: "Describe what you see in this picture. Name the items in this picture. Read these sentences."

0 = No aphasia
1 = Mild-to-moderate aphasia
2 = Severe aphasia
3 = Mute, global aphasia

10. Dysarthria*

Using a simple word list (see reverse), ask the patient to: "Read these words" or "Repeat these words".

0 = Normal articulation
1 = Mild-to-moderate dysarthria
2 = Severe dysarthria

11. Extinction and Inattention*

Sufficient information to determine these scores may have been obtained during the prior testing.

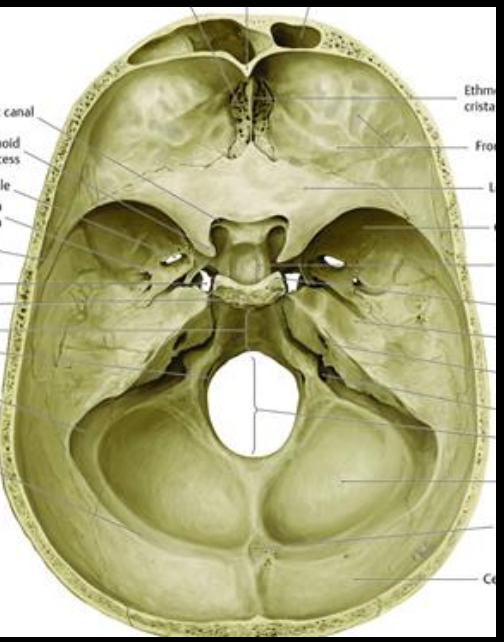
0 = No abnormality
1 = Visual, tactile, auditory, spatial, or personal inattention
2 = Profound hemi-inattention or extinction to more than one modality

How to read a CT scan quickly without a radiologist

Reading a plain CT head

- **“Skull base”:**
  - Medulla, Cerebellum, and Vertebral Arteries
- **“The bridge”:**
  - Pons, and Basilar Artery
- **“Mickey Mouse”:**
  - Midbrain, and Proximal Middle Cerebral Arteries
- **“Angry Emoji”:**
  - Basal ganglia, Insula, MCA ACA and PCA territory
- **“Larva”**
  - Corona radiata
- **“Walnut”:**
  - Centrum semiovale

“Skull base”



Medulla

Cerebellum

Left vertebral artery

Pons

“The bridge”

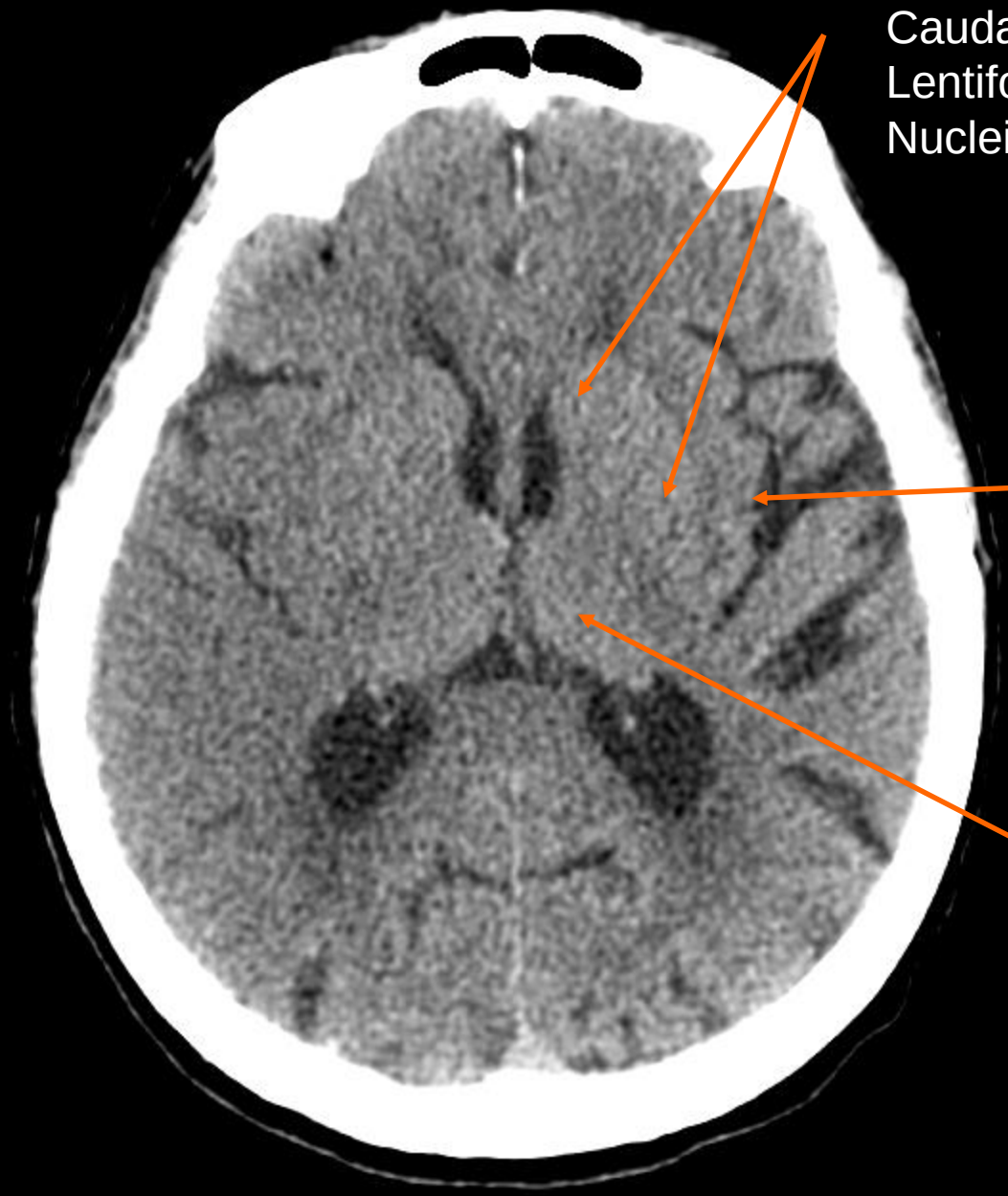
Basilar artery

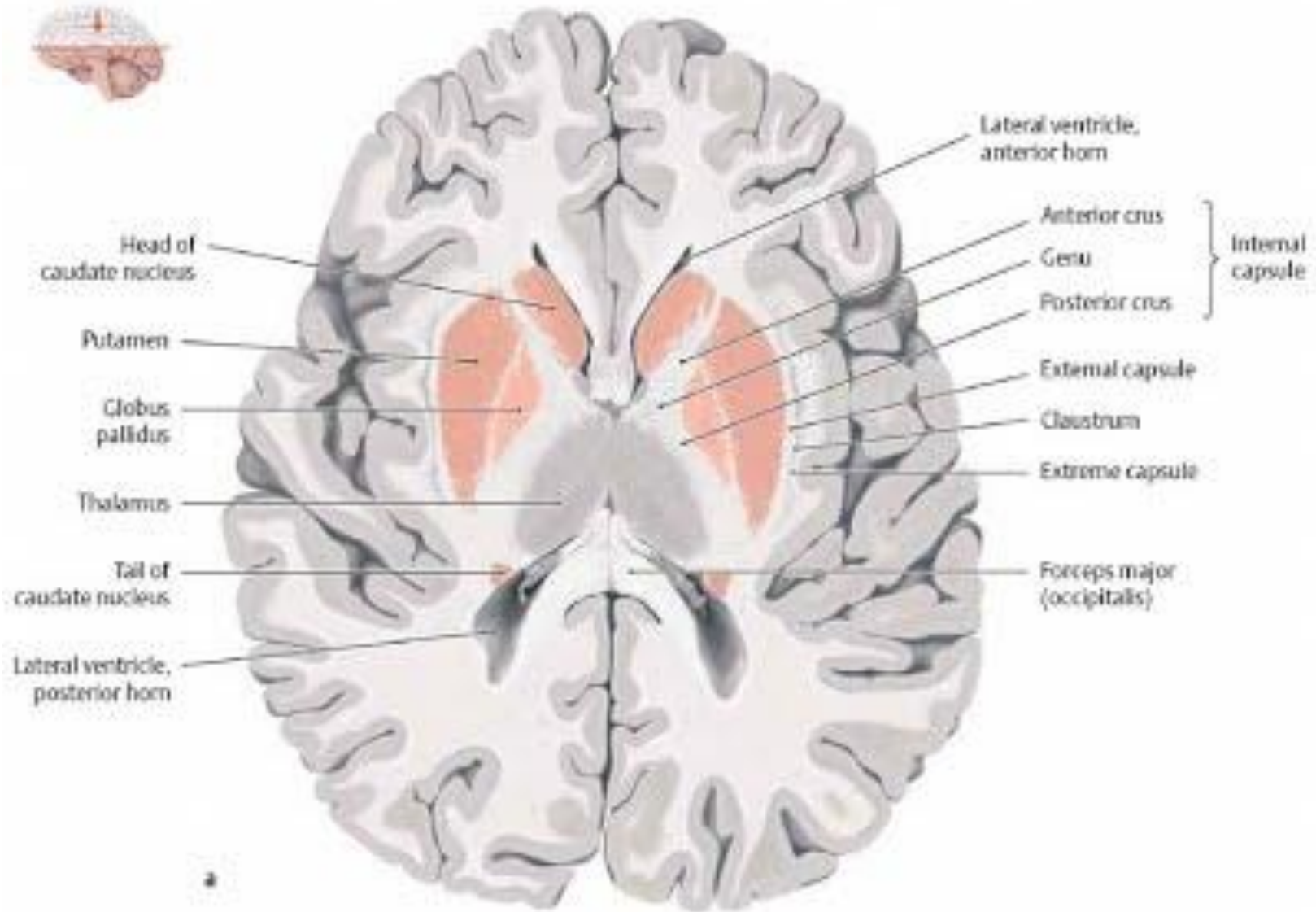
Midbrain

"Mickey Mouse"

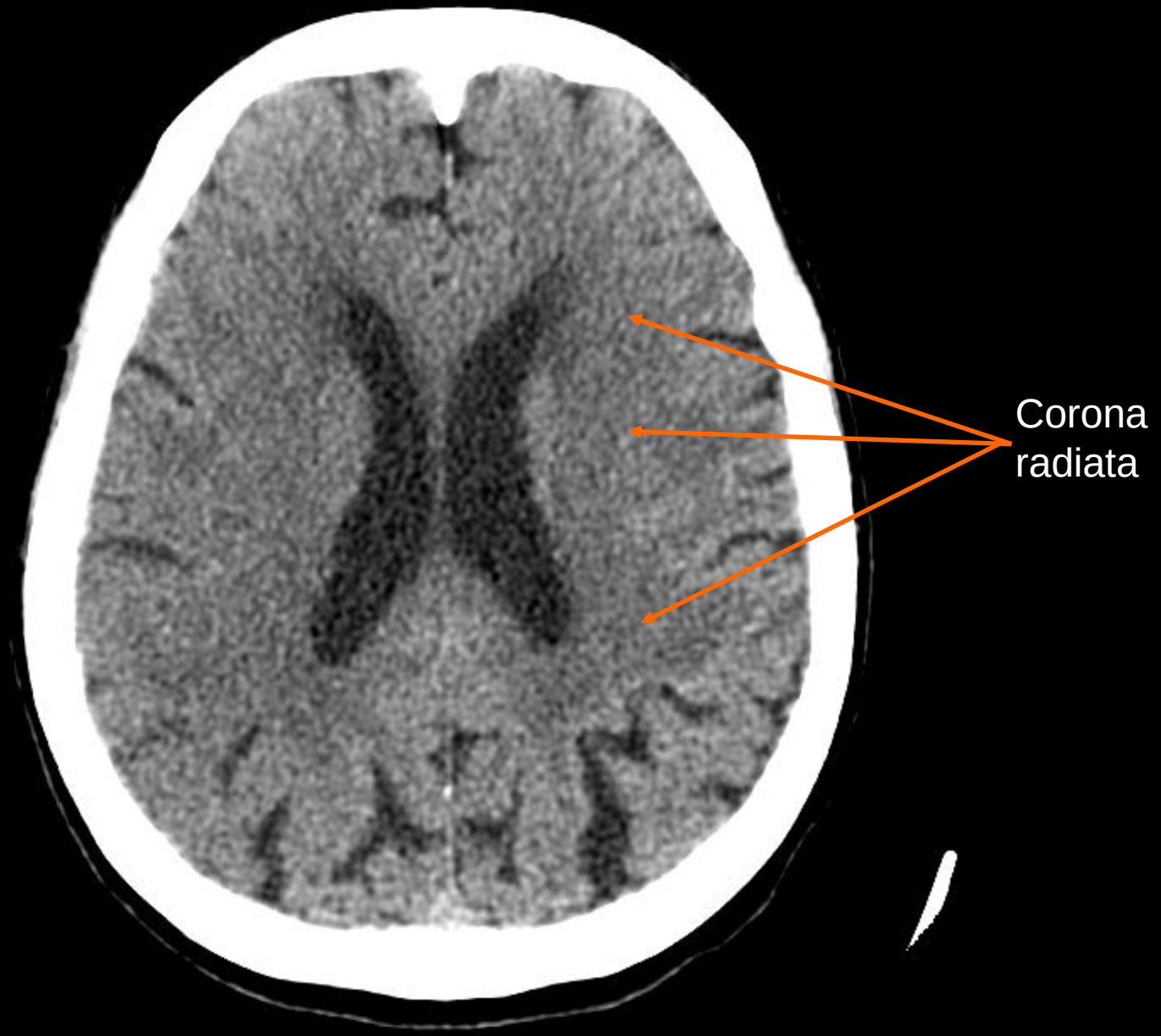
Middle
cerebral artery

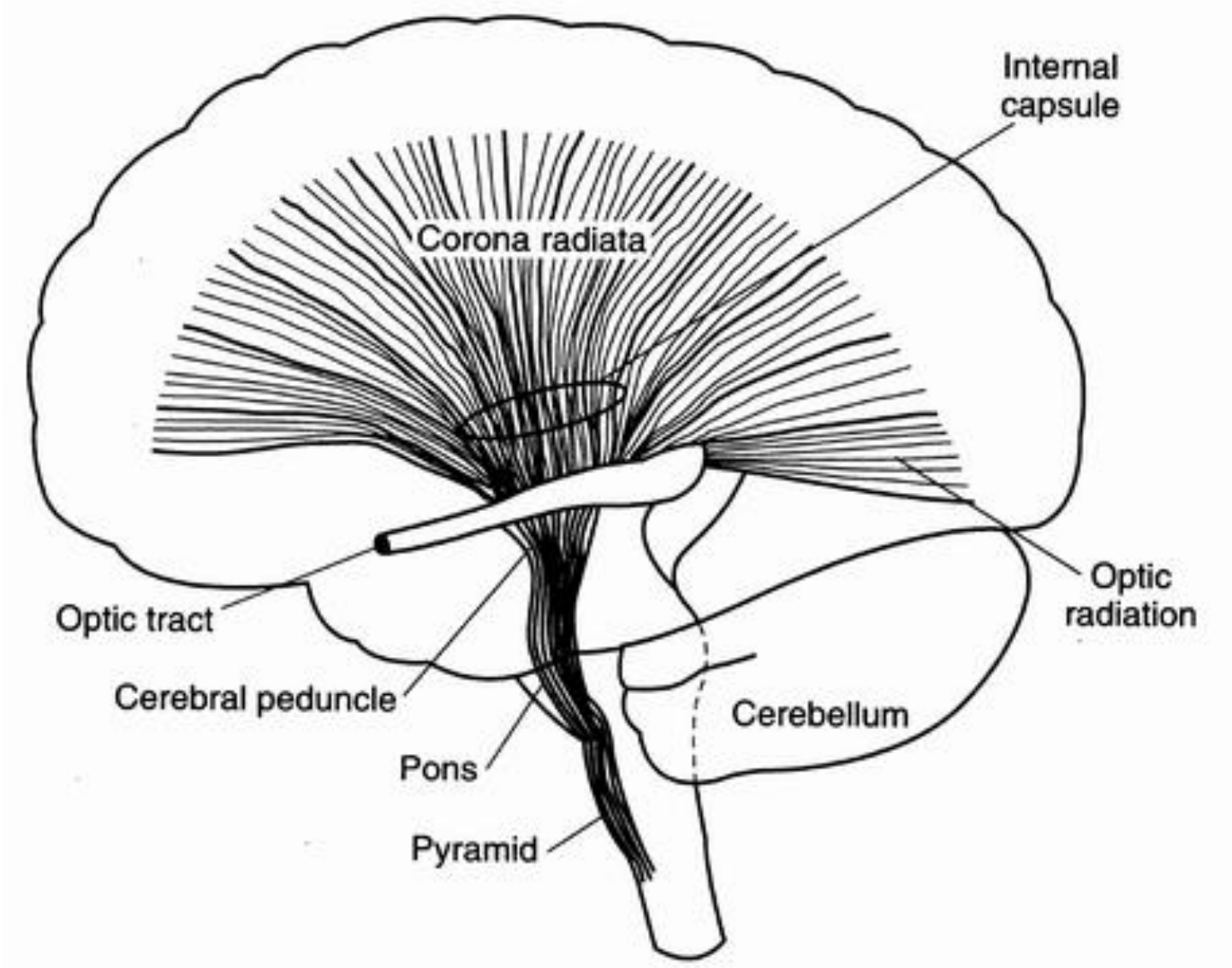
“Angry Emoji”


Basal ganglia:
Caudate and
Lentiform
Nuclei
Insula
Thalamus

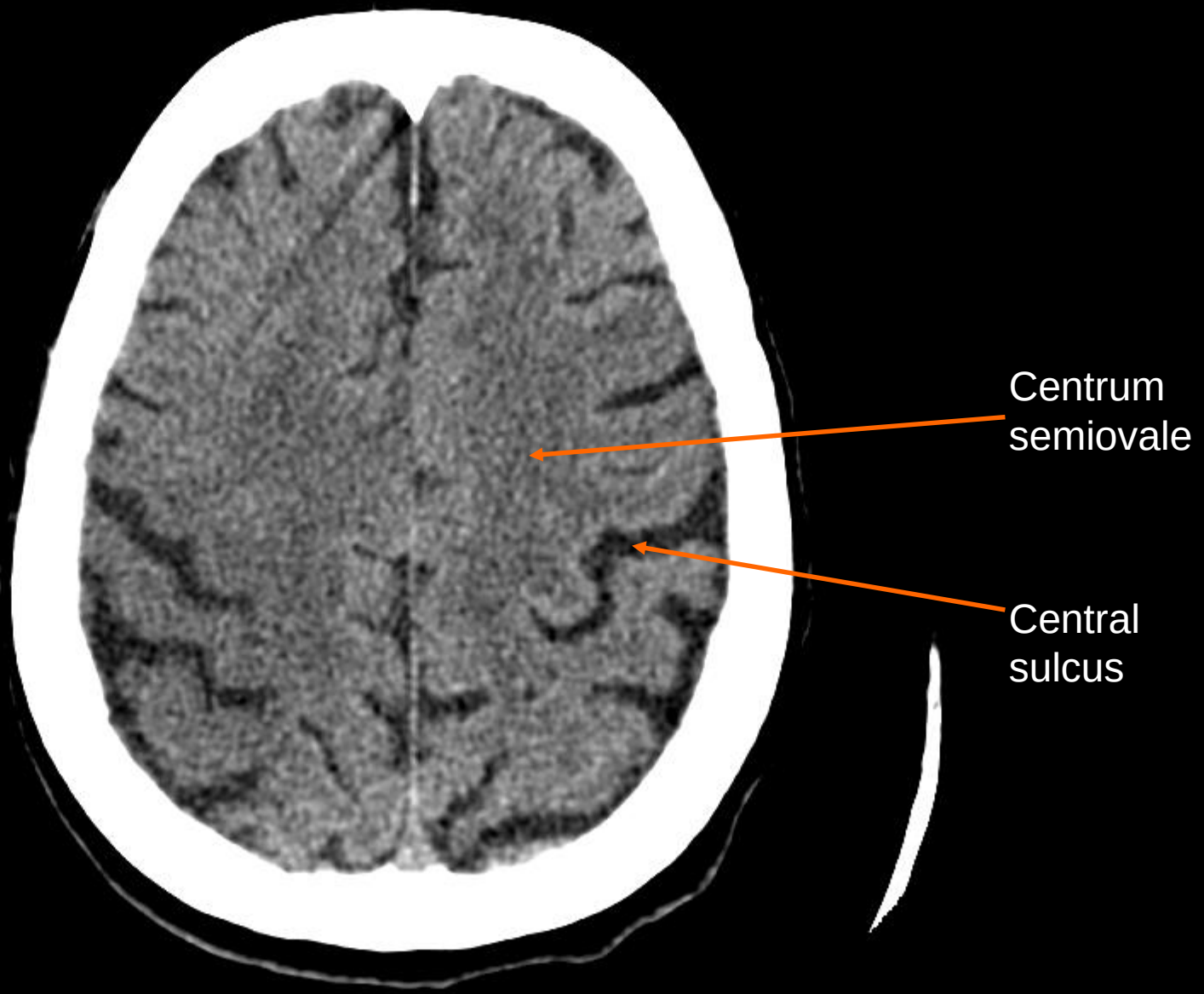

Lateral ventricle, anterior horn
Anterior crus
Genu
Posterior crus
Internal capsule
Head of caudate nucleus
Putamen
Globus pallidus
Thalamus
Tail of caudate nucleus
Lateral ventricle, posterior horn
External capsule
Claustrum
Extreme capsule
Forceps major (occipitalis)
a

“Larva”



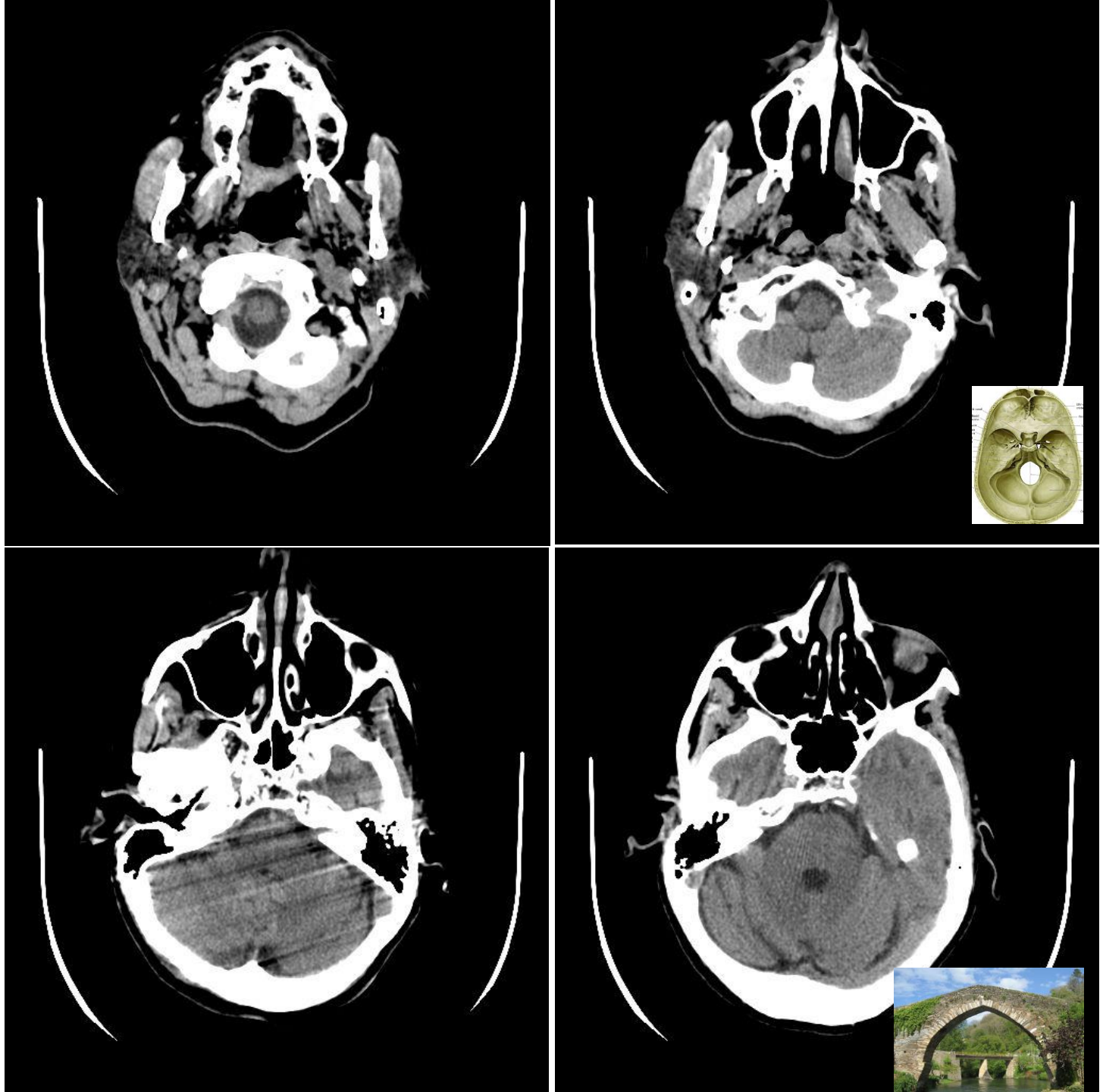

Internal capsule
Corona radiata
Optic radiation
Optic tract
Cerebral peduncle
Cerebellum
Pons
Pyramid

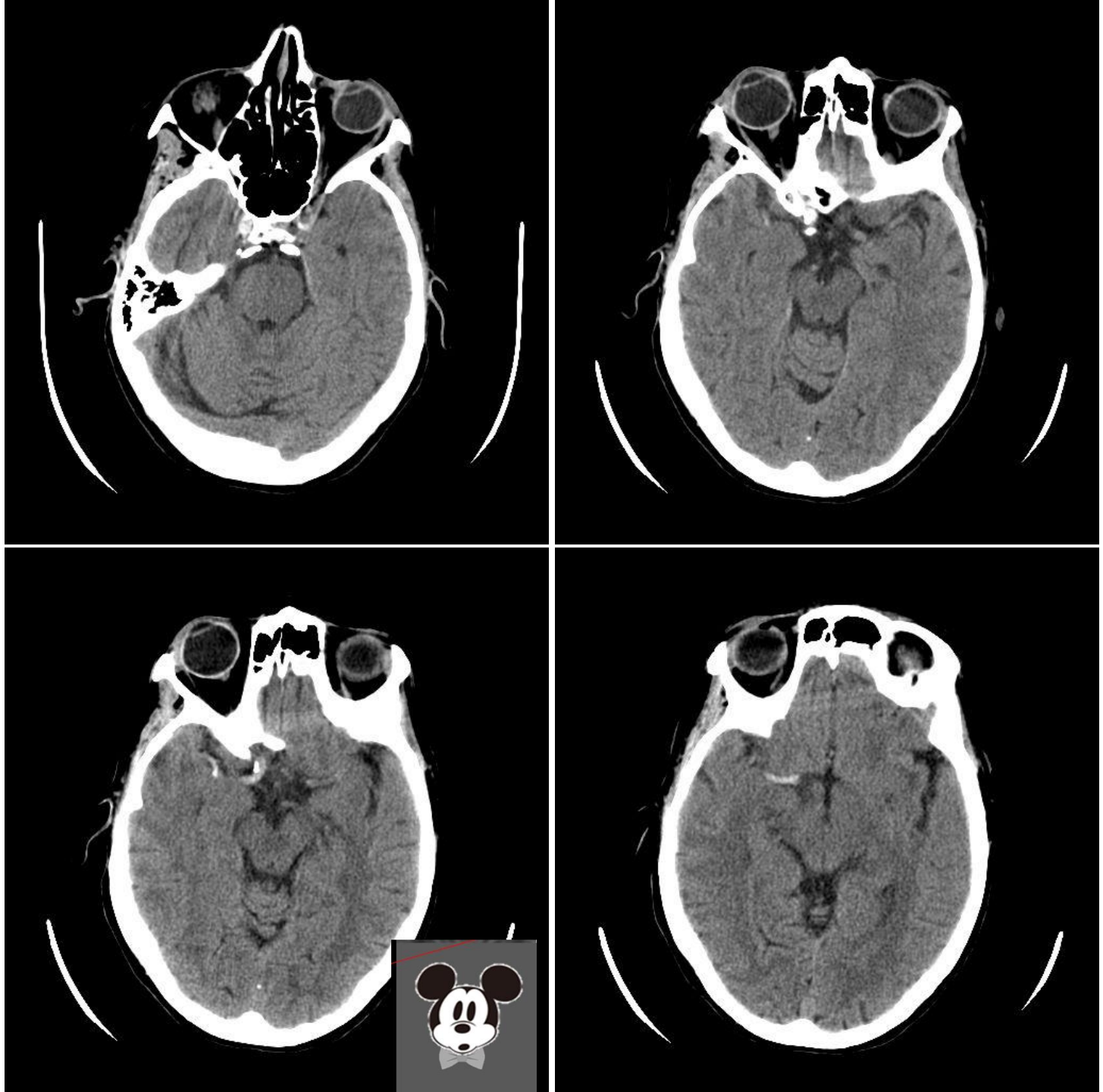
“Walnut”

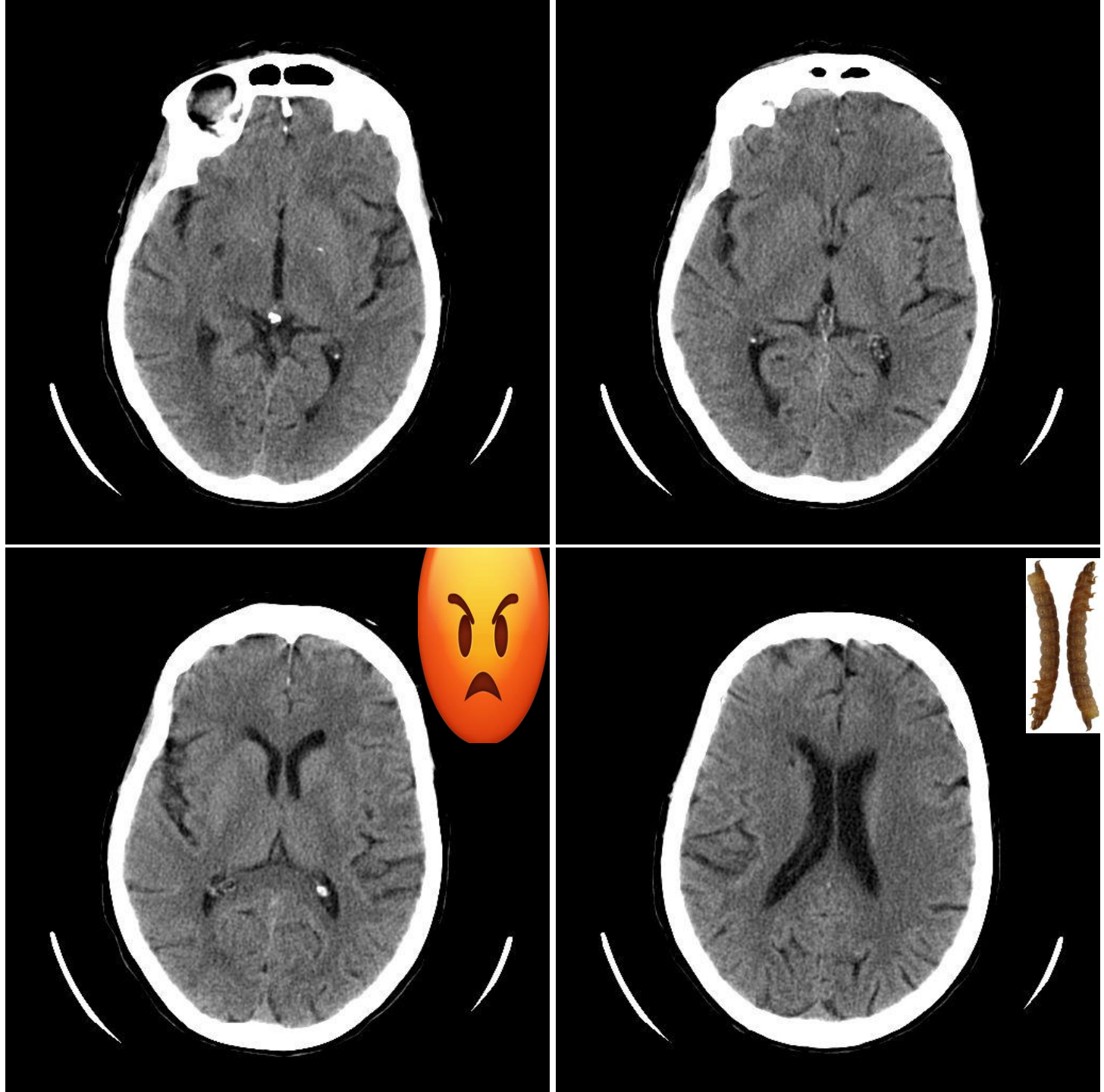


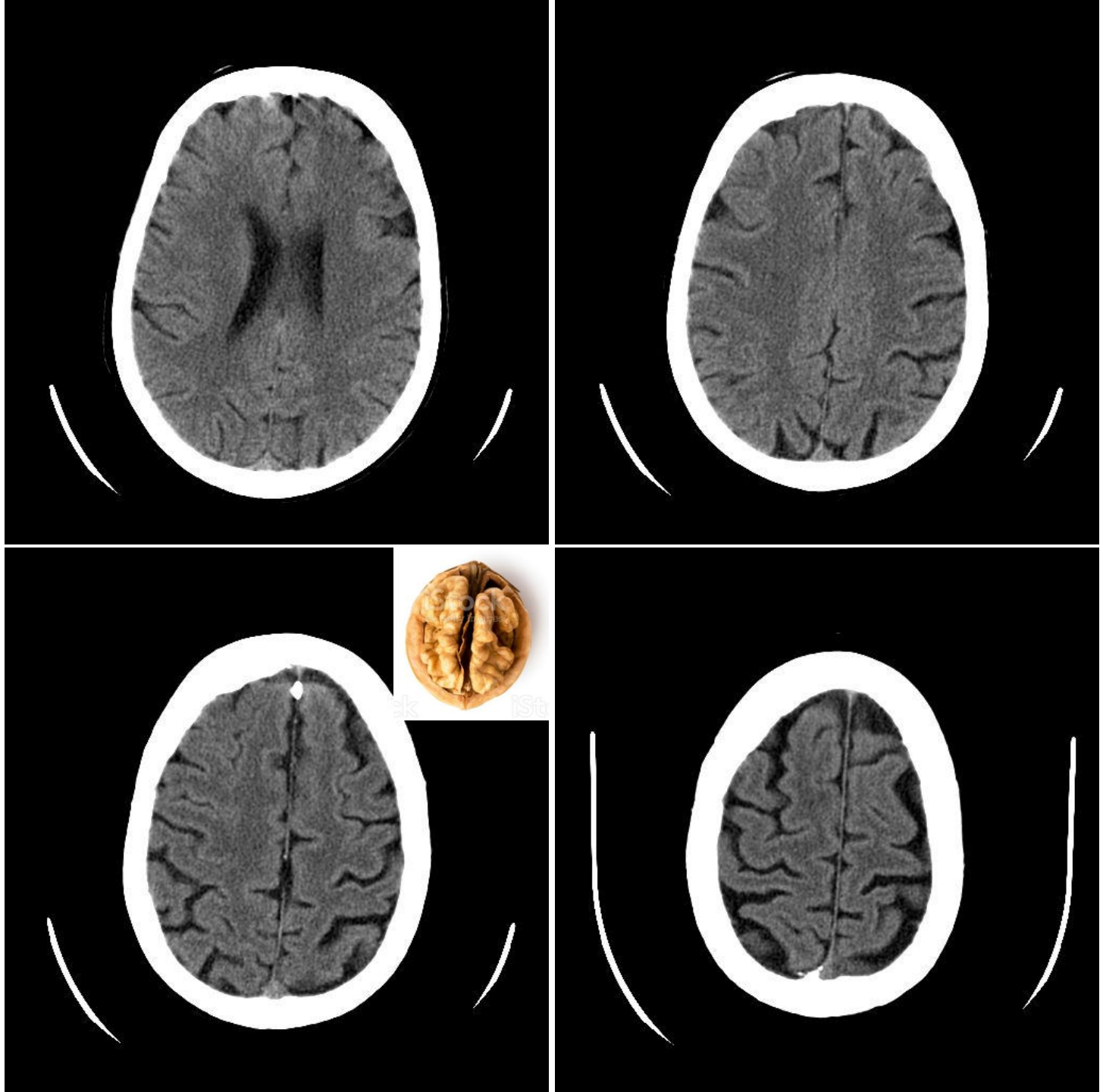
Recognize acute thrombus

- As you review the following slides, recall that the Midbrain level is where you see the proximal MCA (and distal ICA)





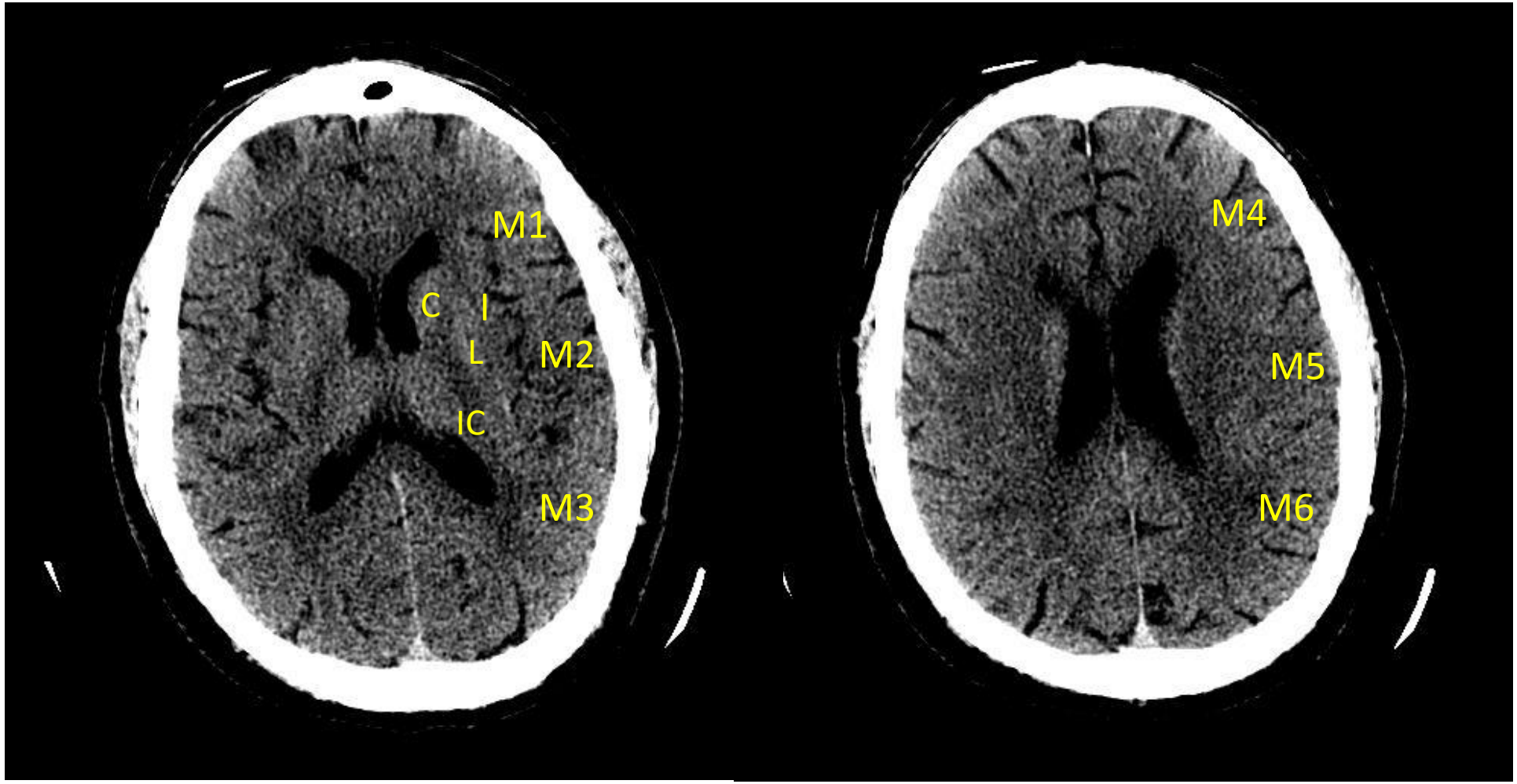




Detecting early cerebral ischemia on CT scan

- Loss of grey-white differentiation
  - You may have to adjust the brightness and contrast (the “window width” and “window level”)
- Loss of sulci
- Use the same system every time you look at a CT for possible acute stroke
  - For example, the Alberta Stroke Program Early CT Score (ASPECTS)

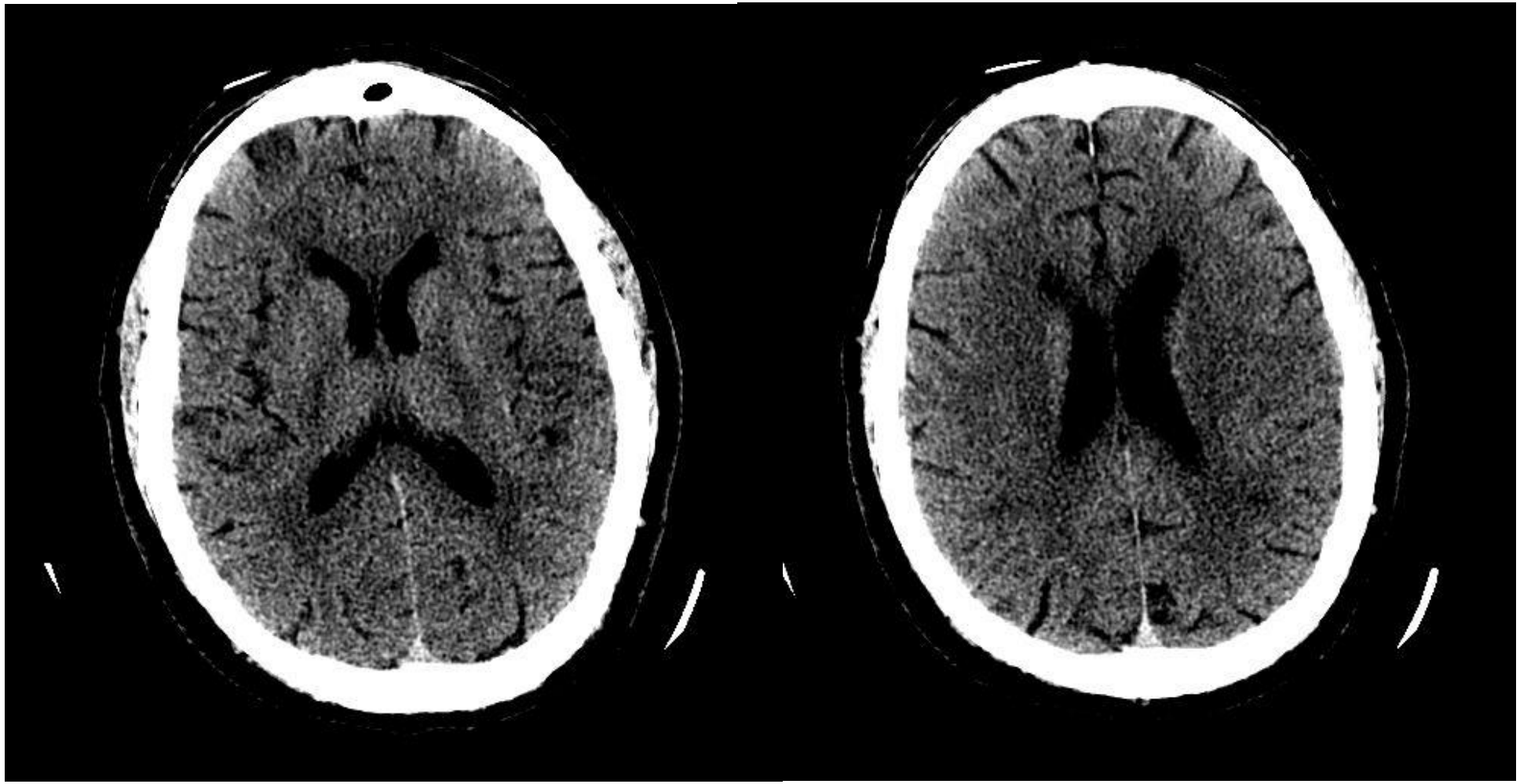
Alberta Stroke Program Early CT Score



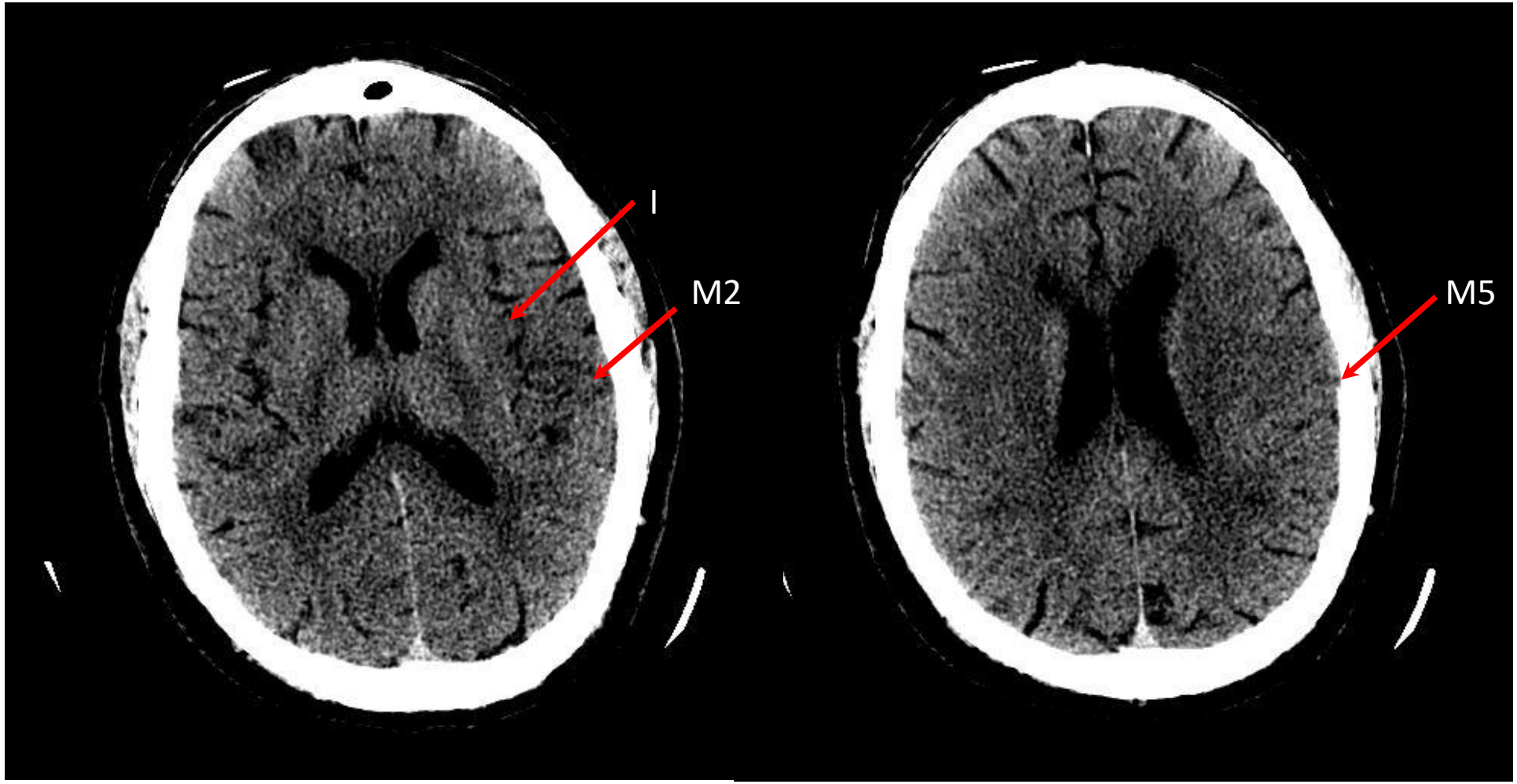
C = caudate, L = lentiform, I = insula, IC = internal capsule

M1, M2, M3 = anterior, lateral, posterior MCA territory; M4 to M6 are above the lentiform nuclei

Right hemiparesis and aphasia: Where is the infarct?

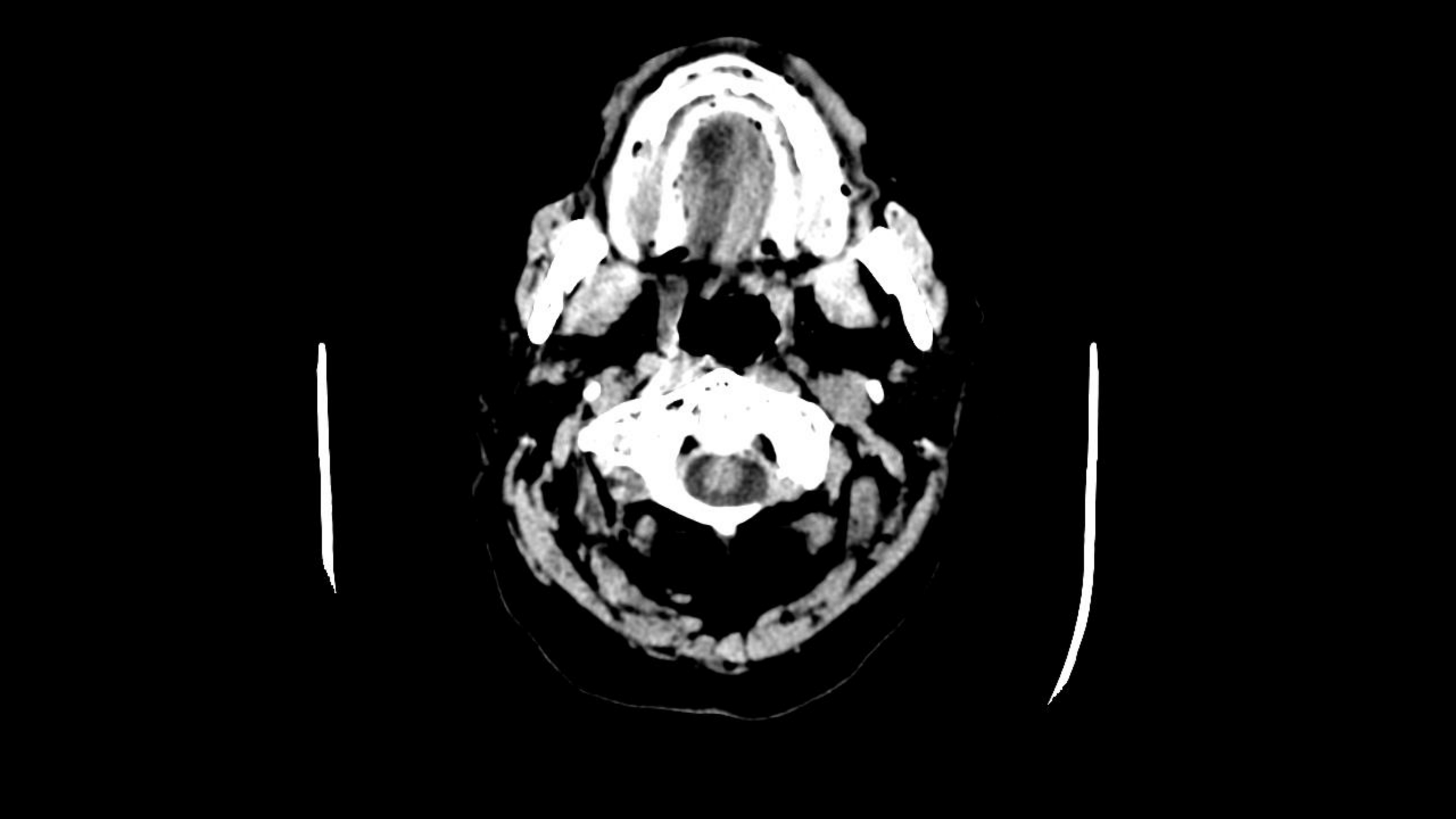


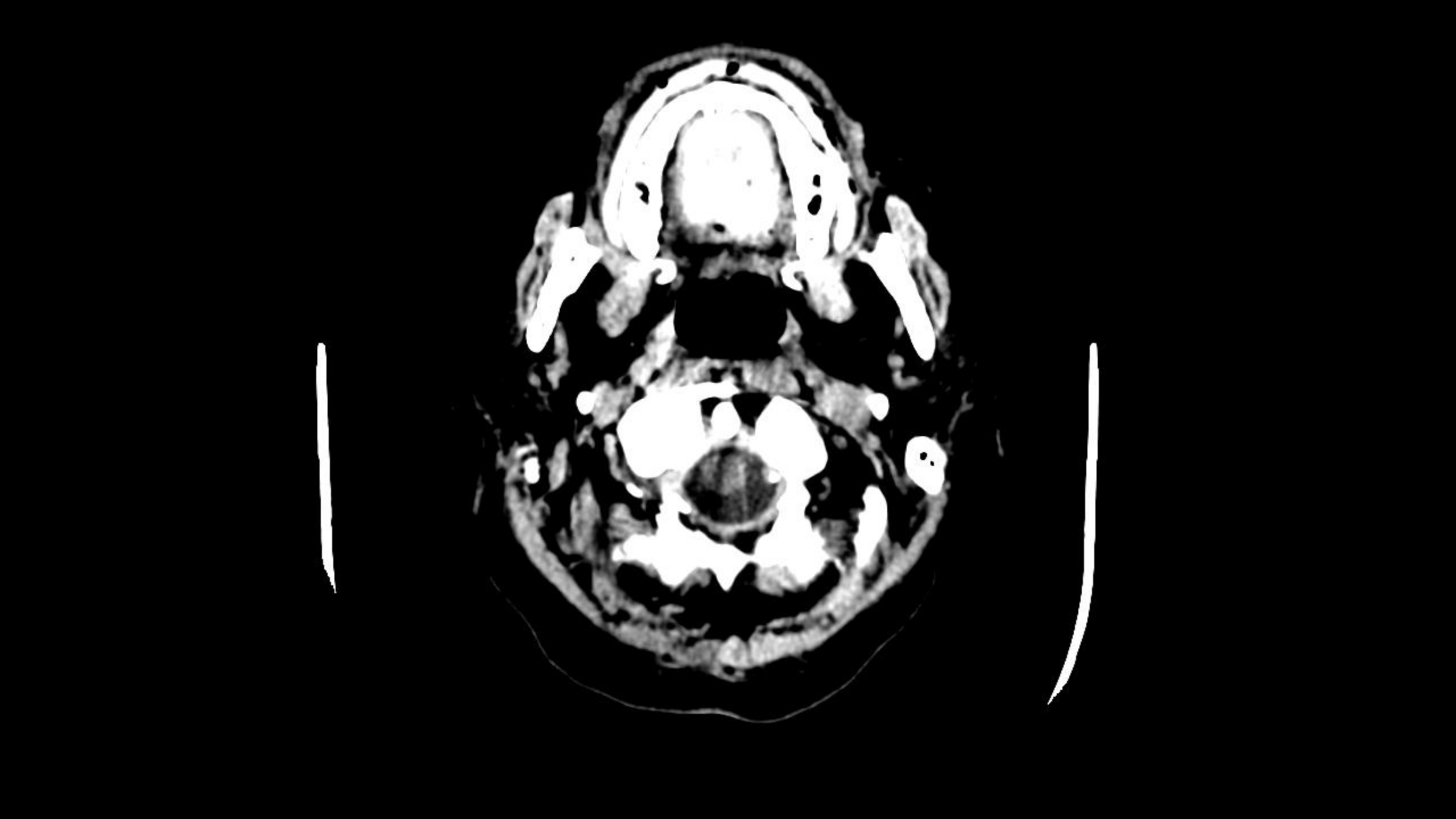
Can you see the infarct using ASPECTS?

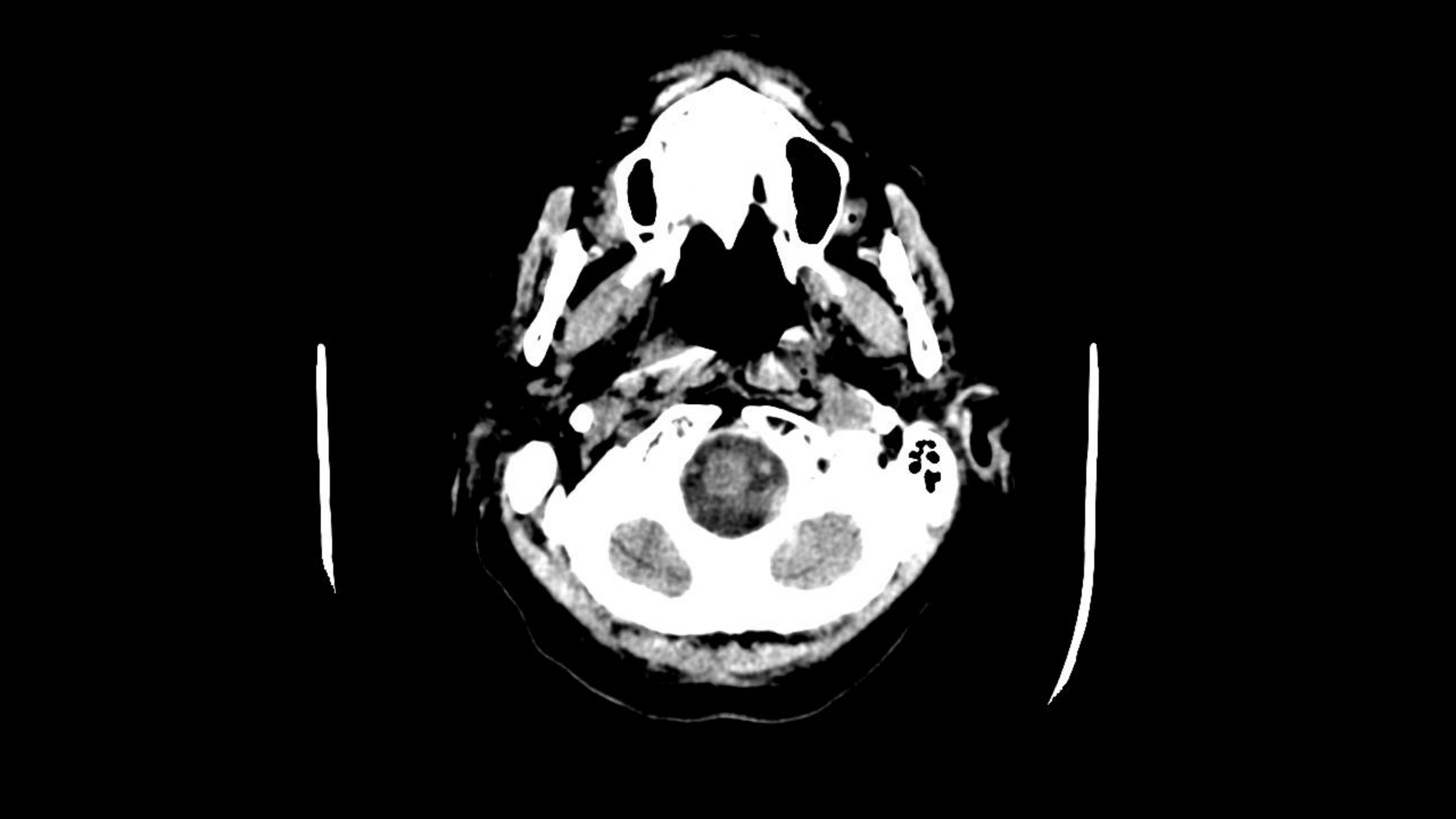


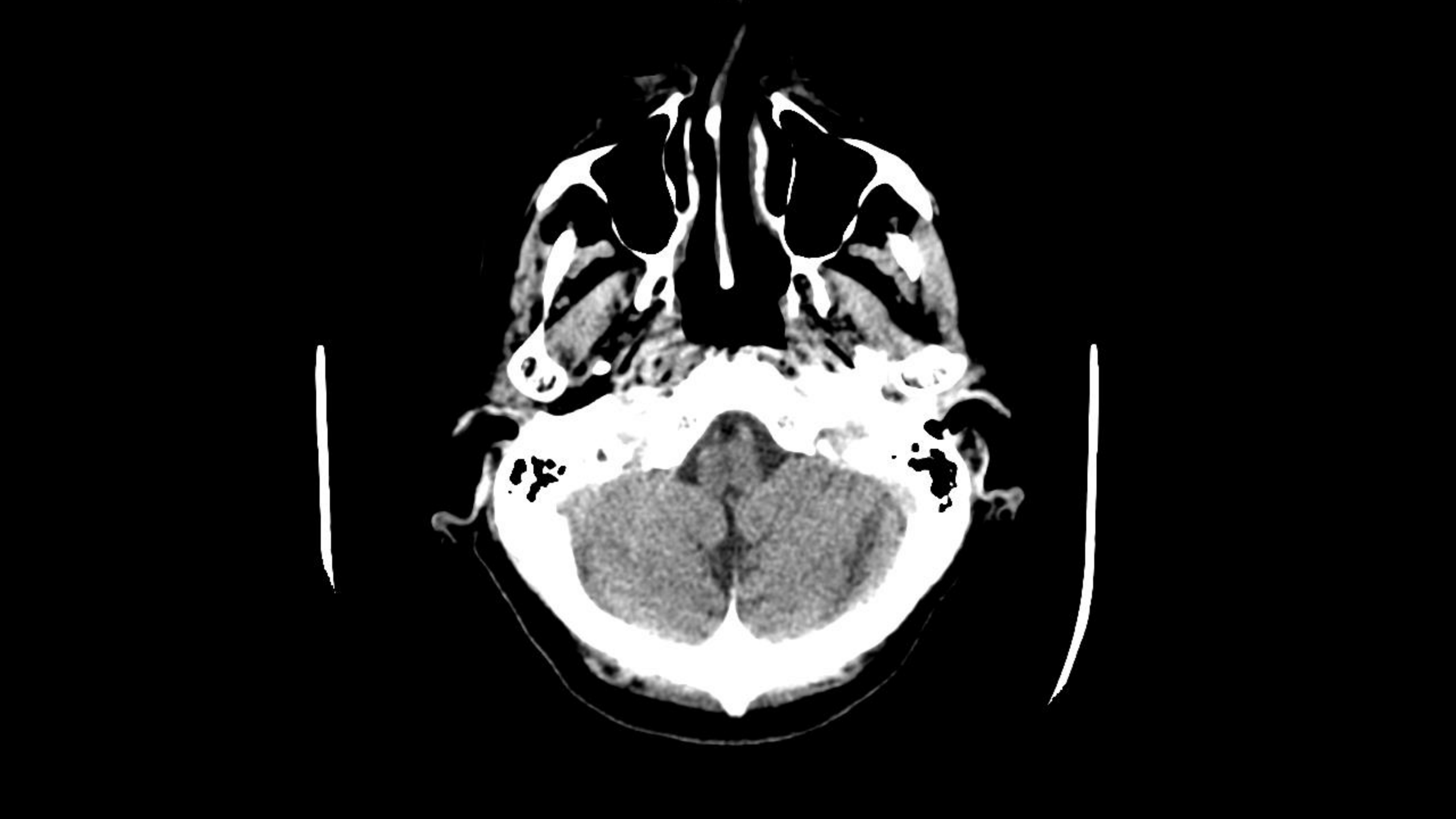
Case

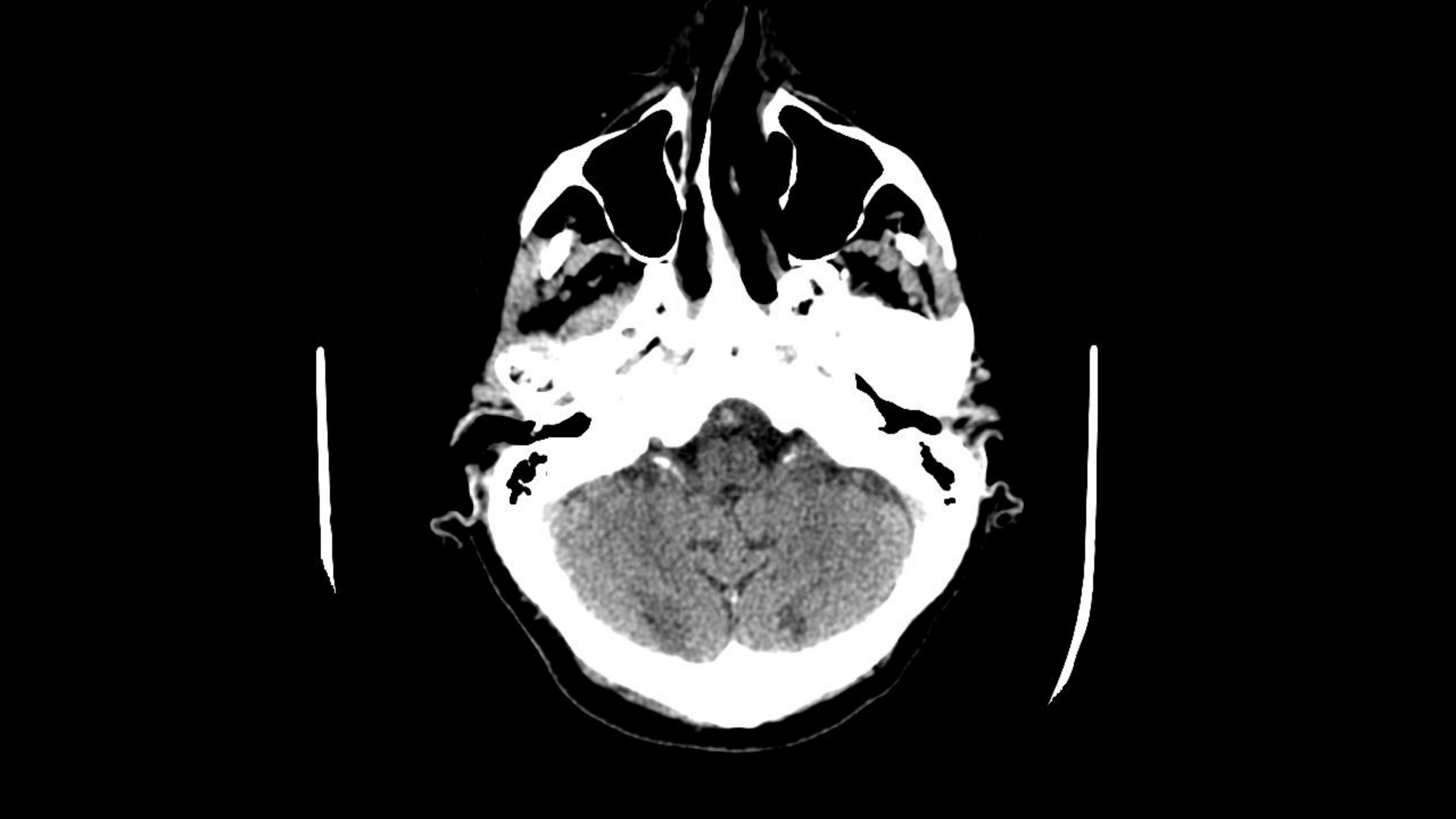
- 77 year old female with left hemiparesis, left homonymous hemianopia, left side sensory loss

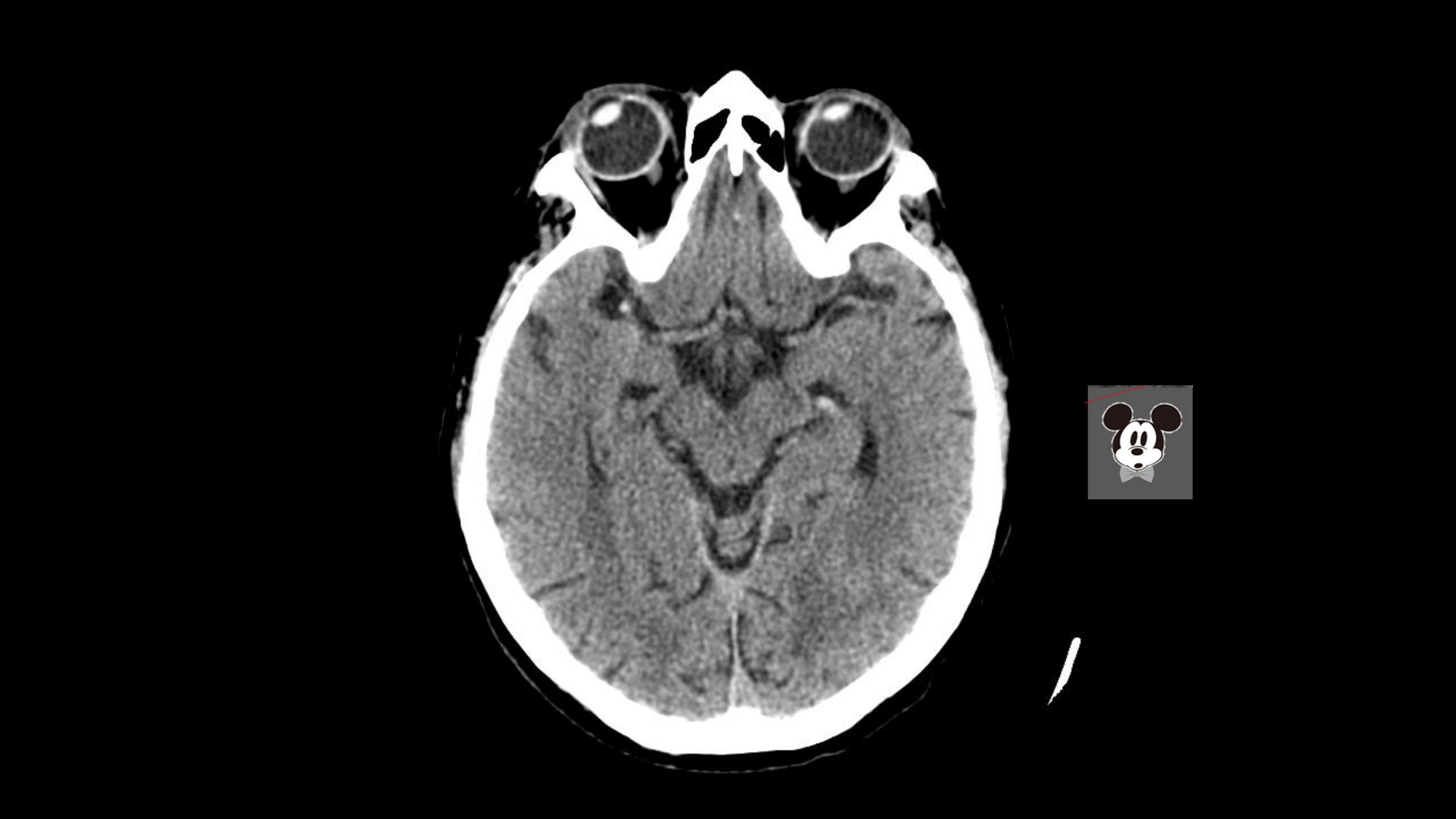


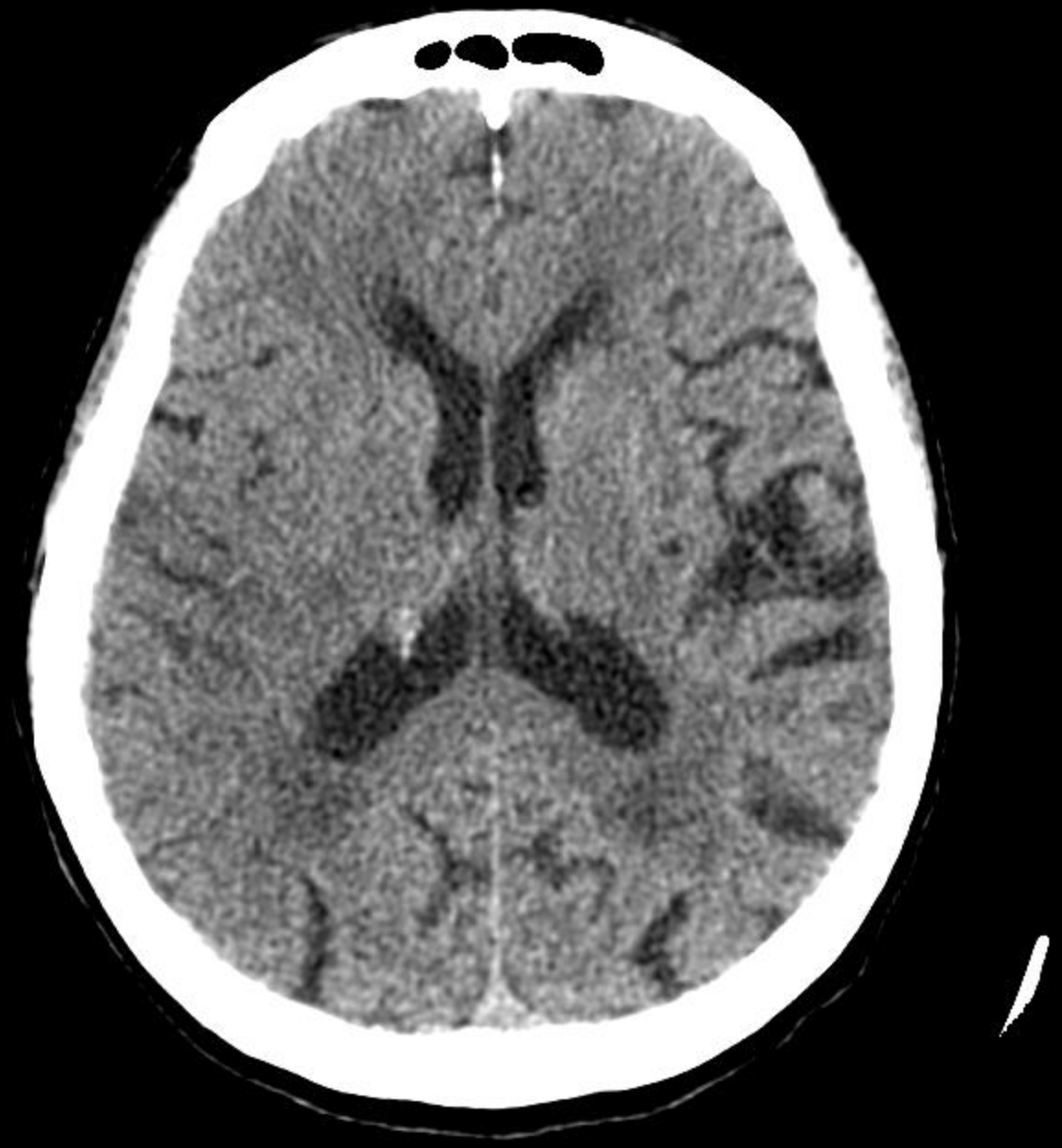


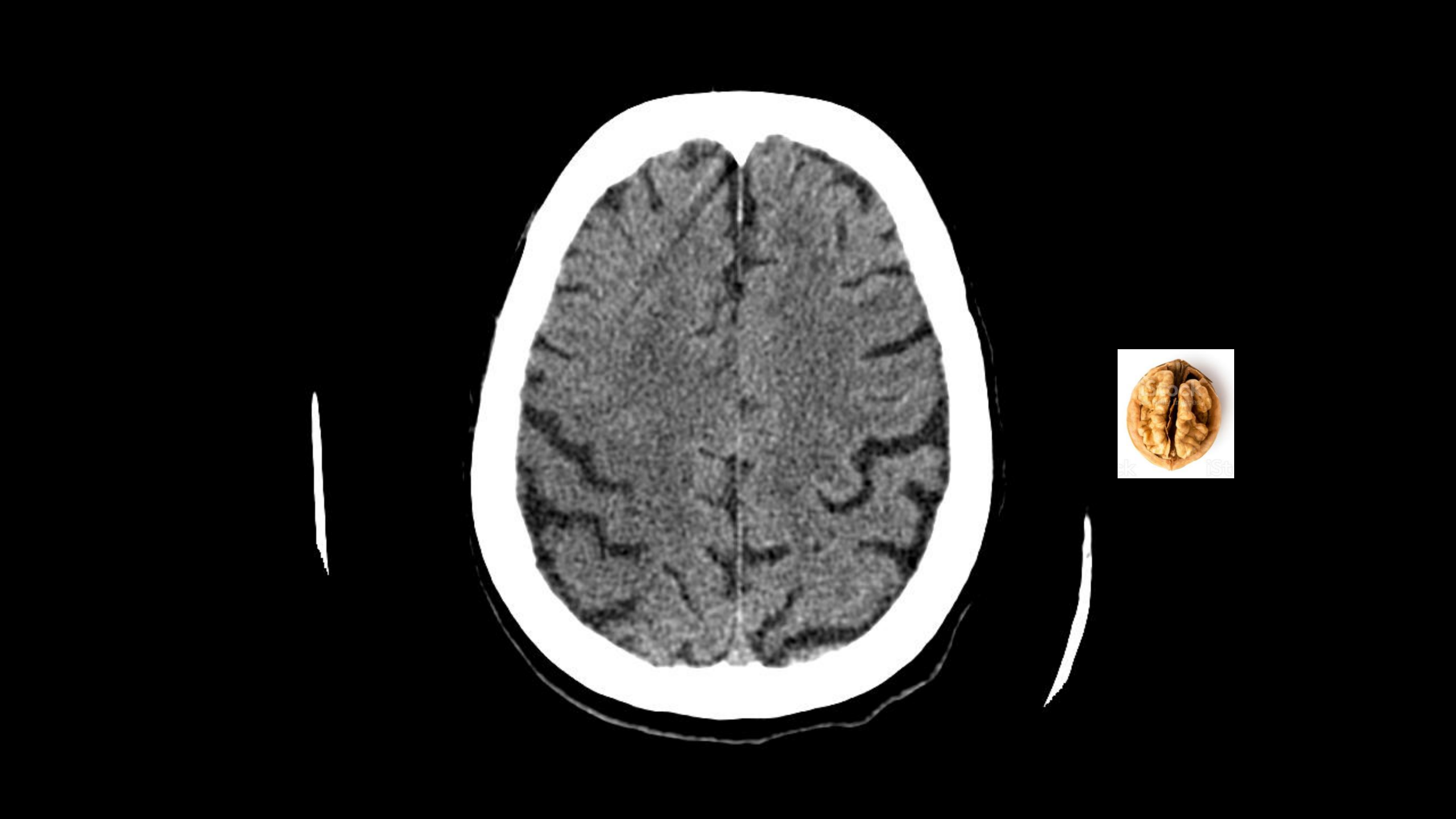


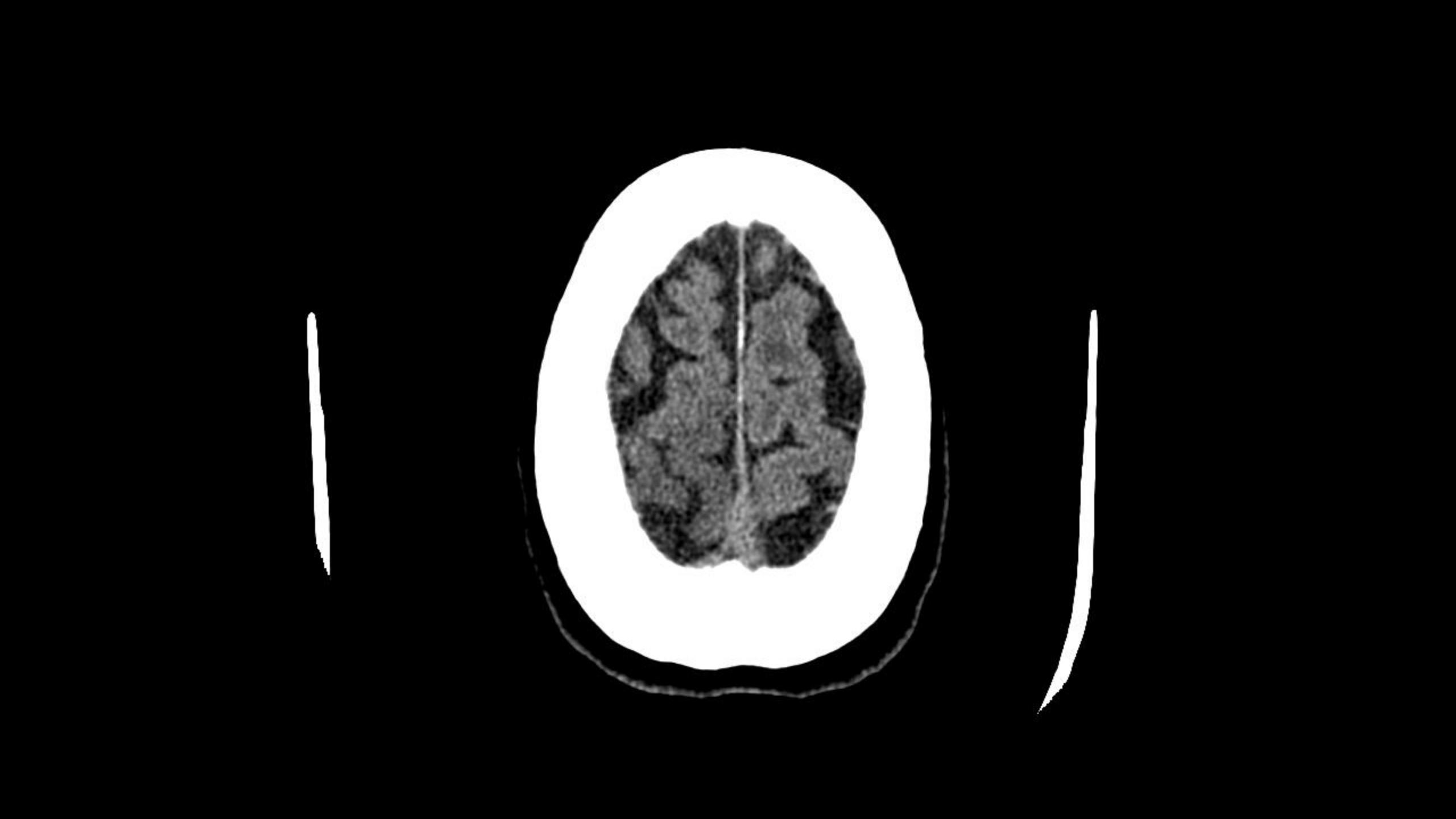


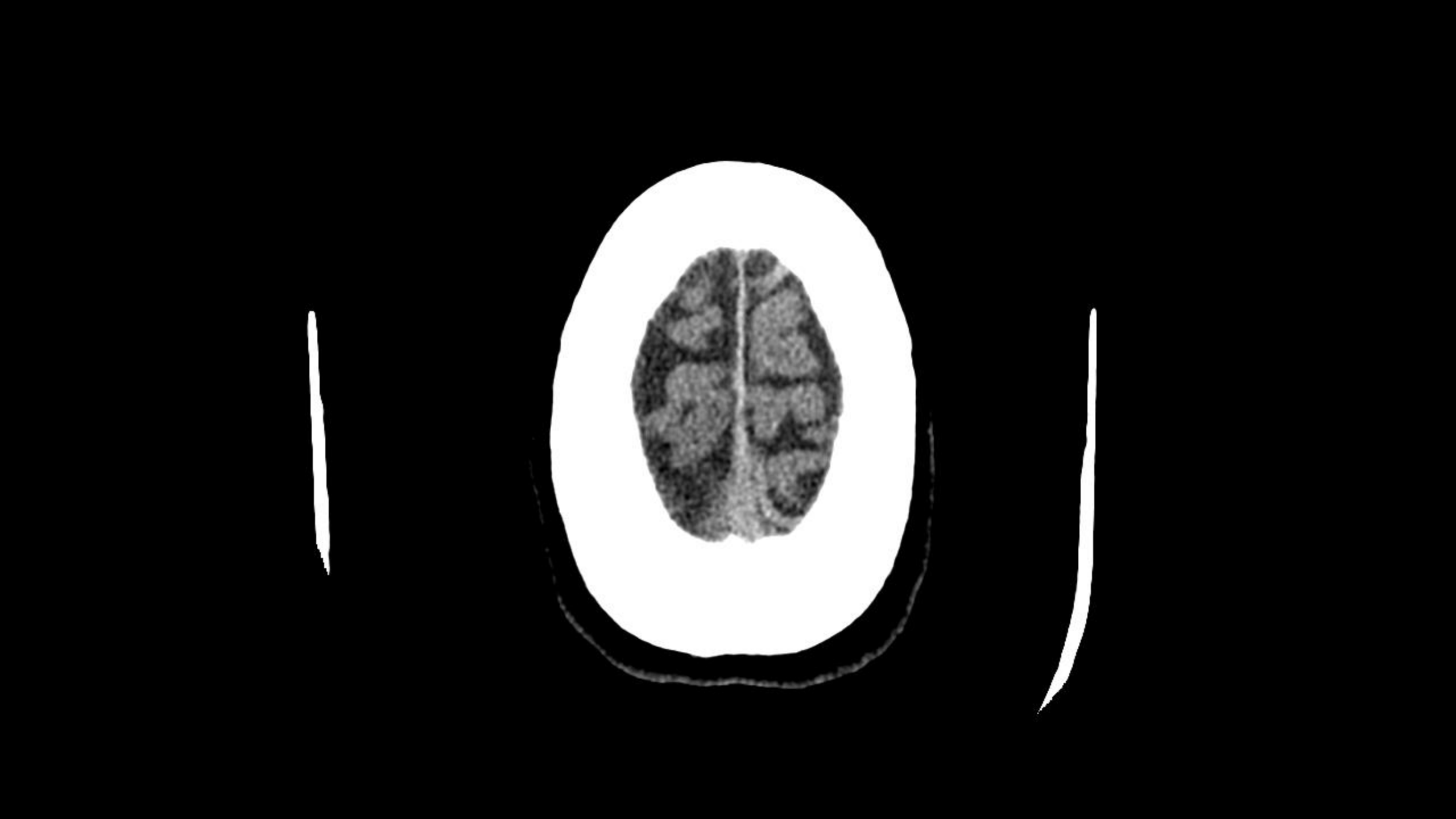


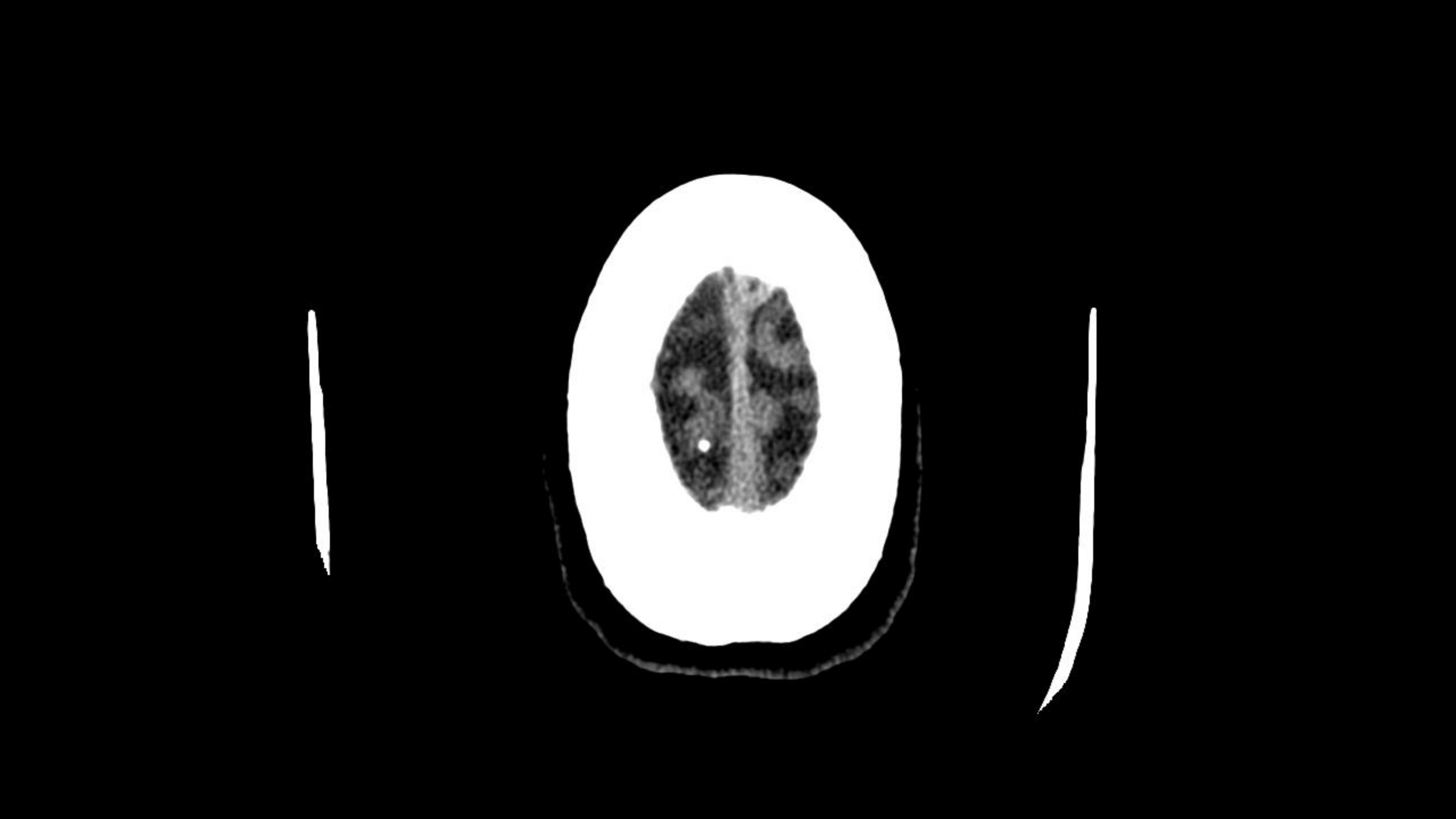






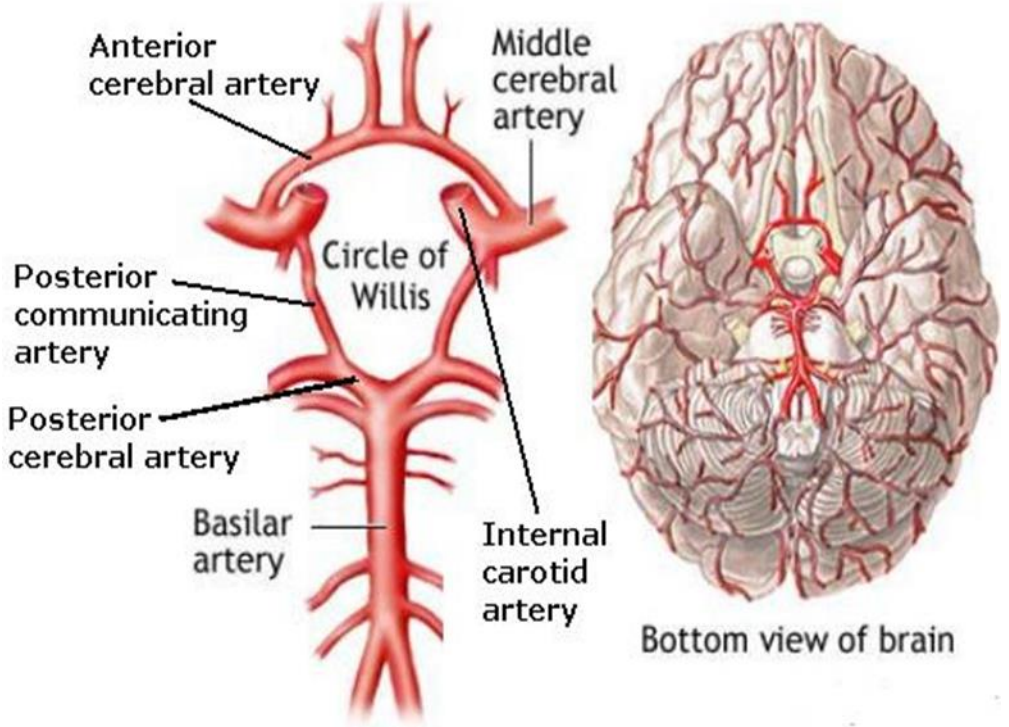




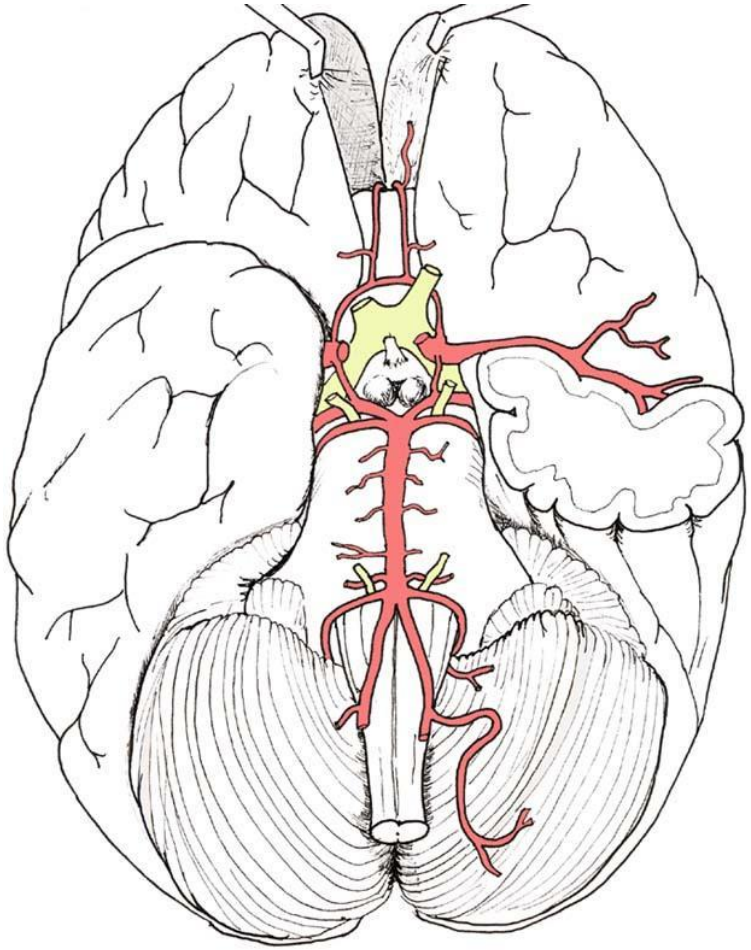


Putting it all together: Stroke syndromes

- Middle cerebral artery
- Anterior cerebral artery
- Posterior cerebral artery
- Brainstem and cerebellum
- Lacunar stroke syndromes

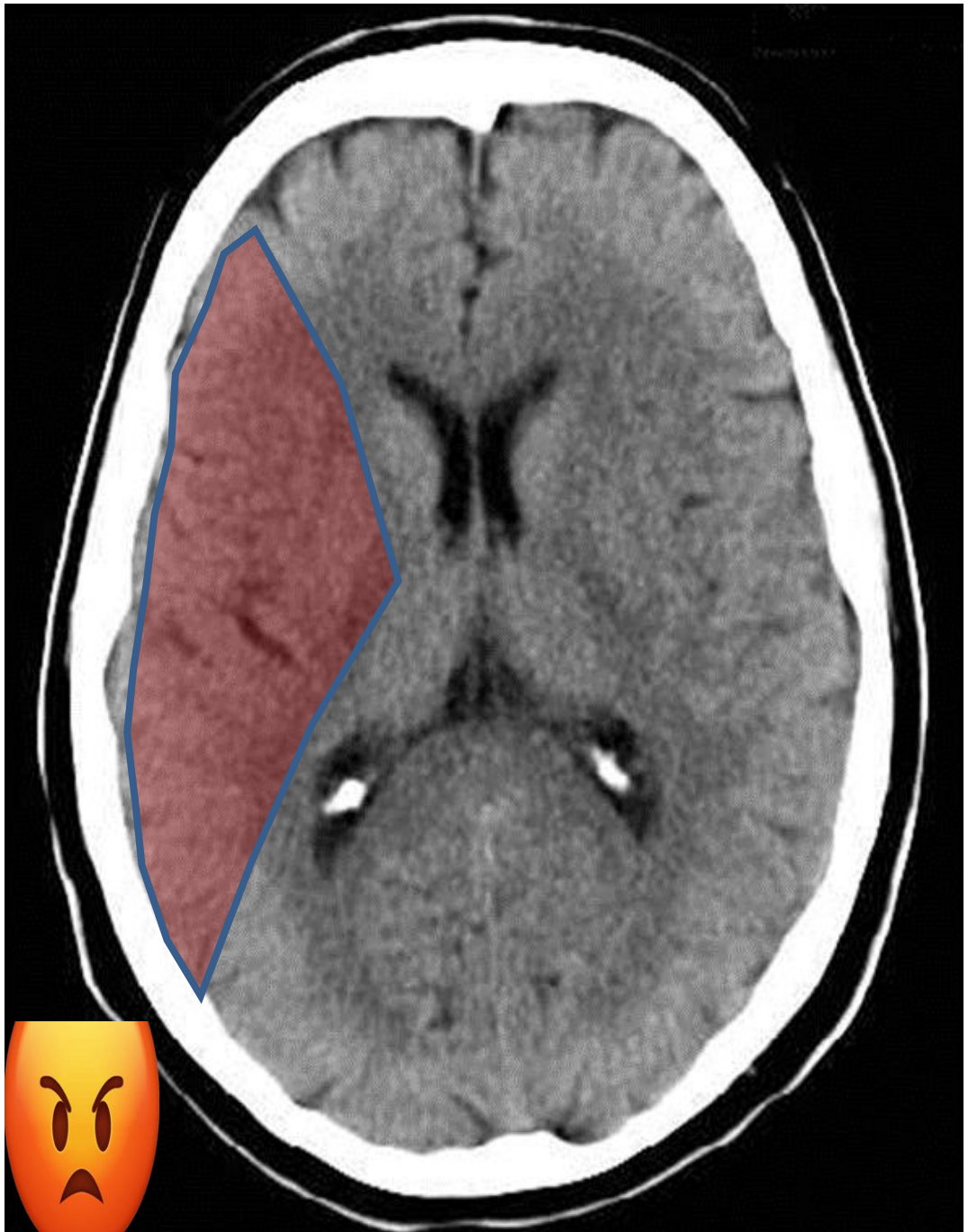


Middle cerebral artery

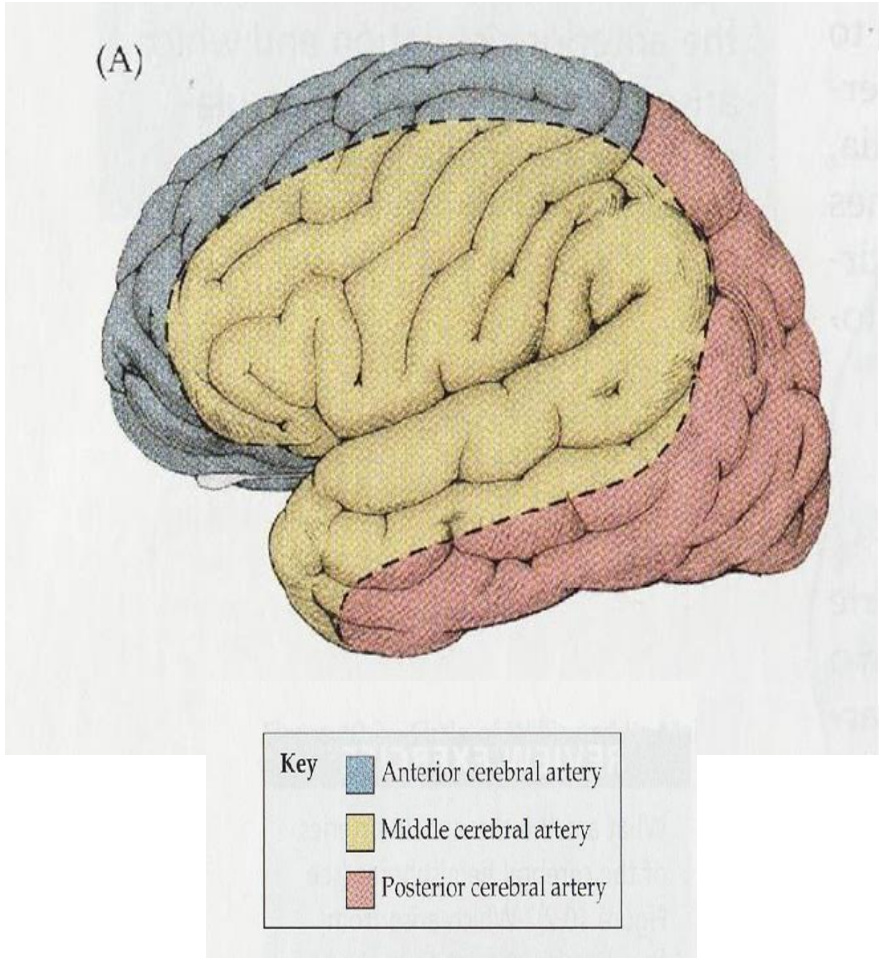


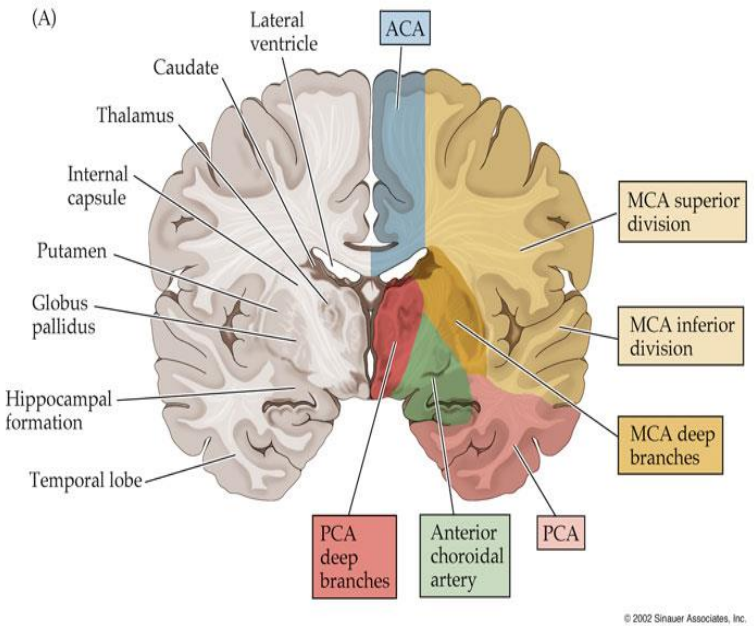
- About two-thirds of all ischemic stroke occurs in the middle cerebral artery territory
- MCA stroke can involve the frontal, temporal, and parietal lobes
- MCA stroke can also involve the basal ganglia through the *lenticulostriate arteries*

- The MCA covers a large territory shown in blue on this CT scan image taken at the basal ganglionic level



MCA (yellow) covers a large portion of the hemisphere





Middle cerebral artery

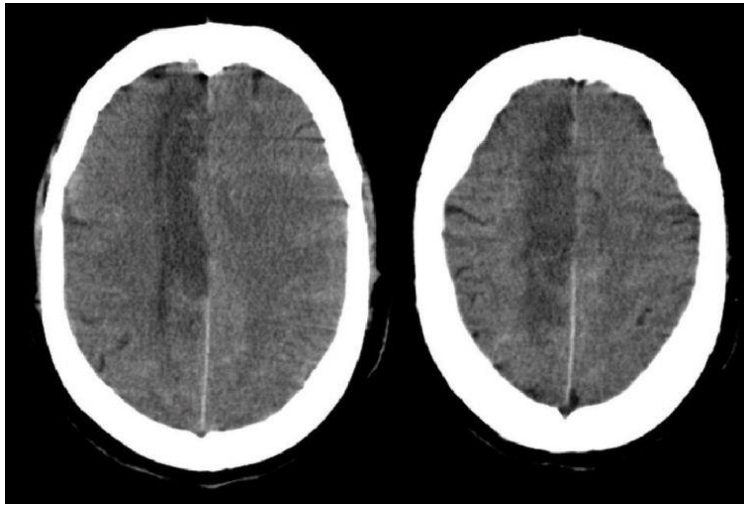
- Left MCA:
  - Right hemiparesis, aphasia, right hemianopia, right side sensory loss, dysarthria
  - Doesn't have to have all of these deficits
  - Sometimes just aphasia

- Right MCA:
  - Left hemiparesis, inattention or neglect, left hemianopia, left side sensory loss, dysarthria
  - Sometimes patients don't follow commands but they aren't aphasic, they are just unable to process any information quickly (not just language)
  - Inattention can be for visual, auditory or tactile stimuli

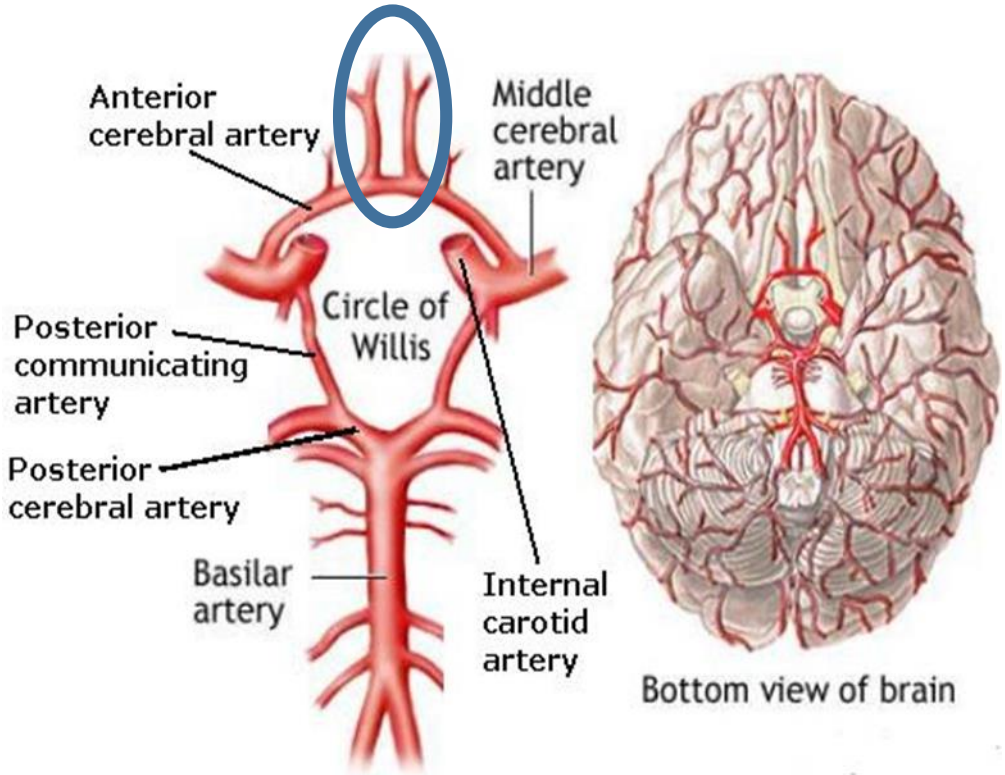
Why does it sometimes seem that someone with a RMCA stroke is aphasic?

- With RMCA stroke, **consciousness or attention** are often compromised
- This can be misinterpreted as aphasia when the patient doesn't follow commands or when they don't speak clearly
- **Selective focus** can be affected even if patient is alert
  - Inattention or neglect of left side
  - Inability or slow to process multiple stimuli, i.e. confusion
  - When patients are confused or overwhelmed with stimuli, they sometimes aren't able to focus on speech
  - Often patients will be easily distracted or not focus on the exam

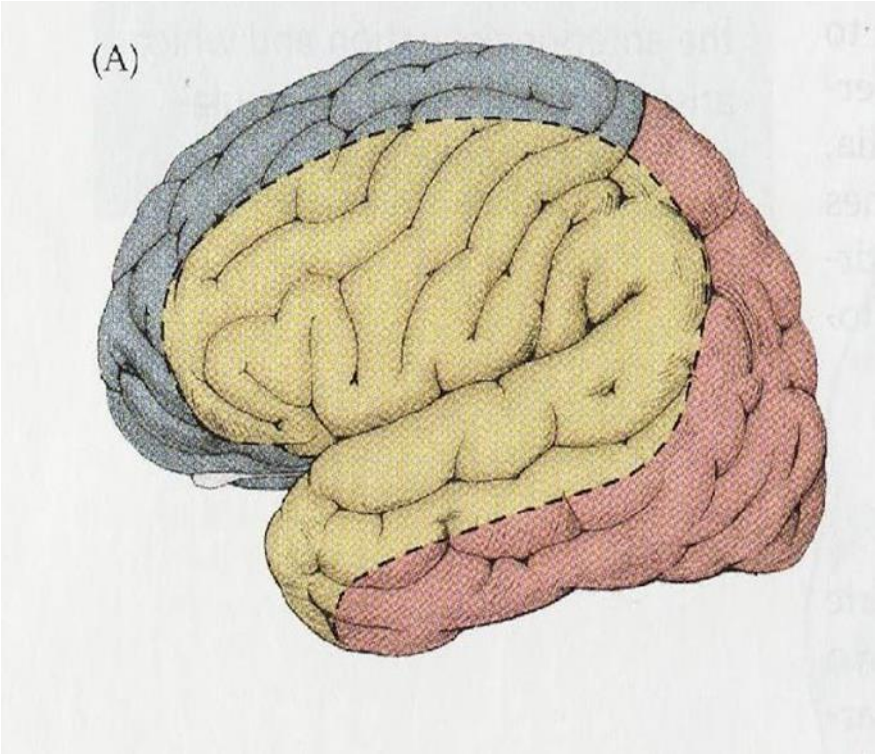
Anterior cerebral artery

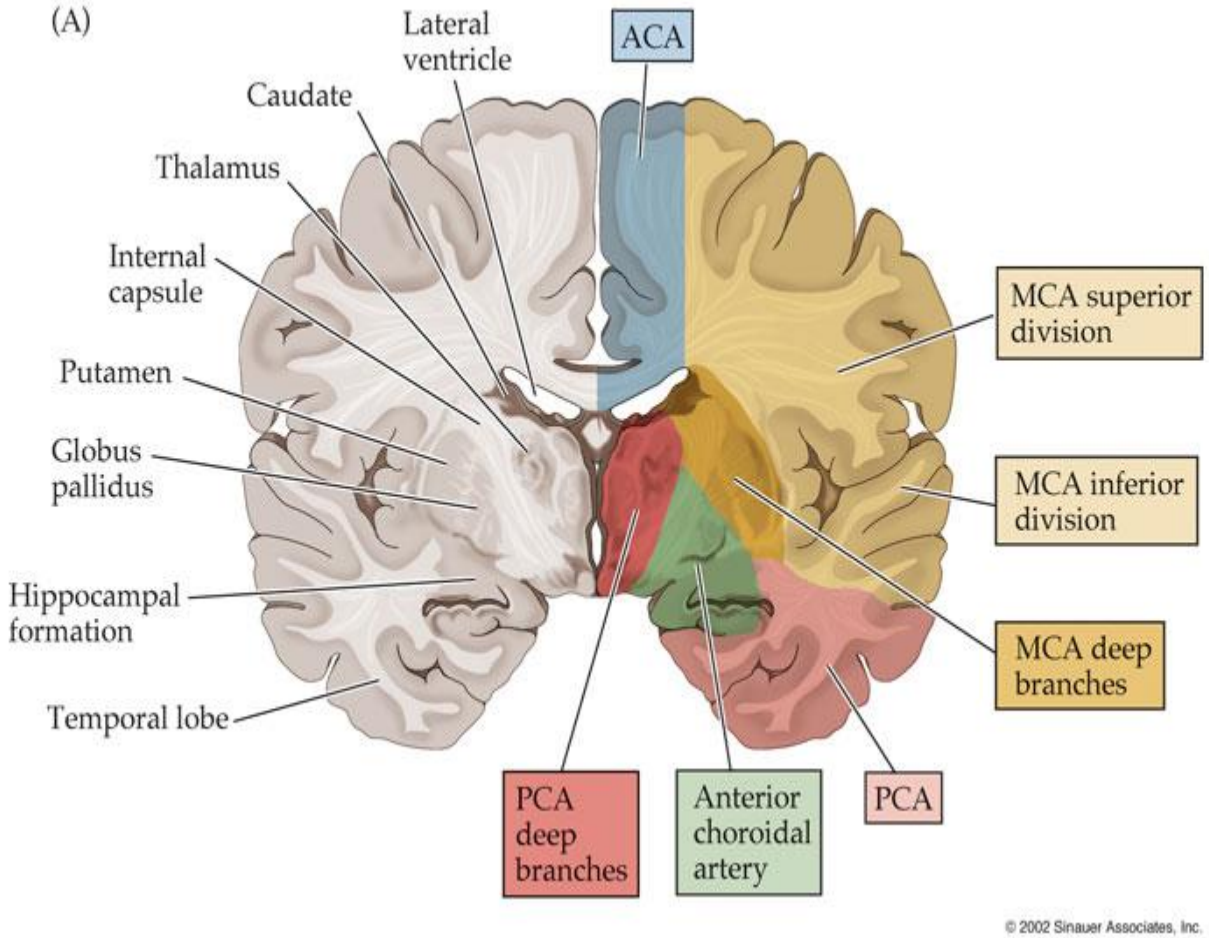


- Leg > arm, face weakness, abulia, changes in emotional affect

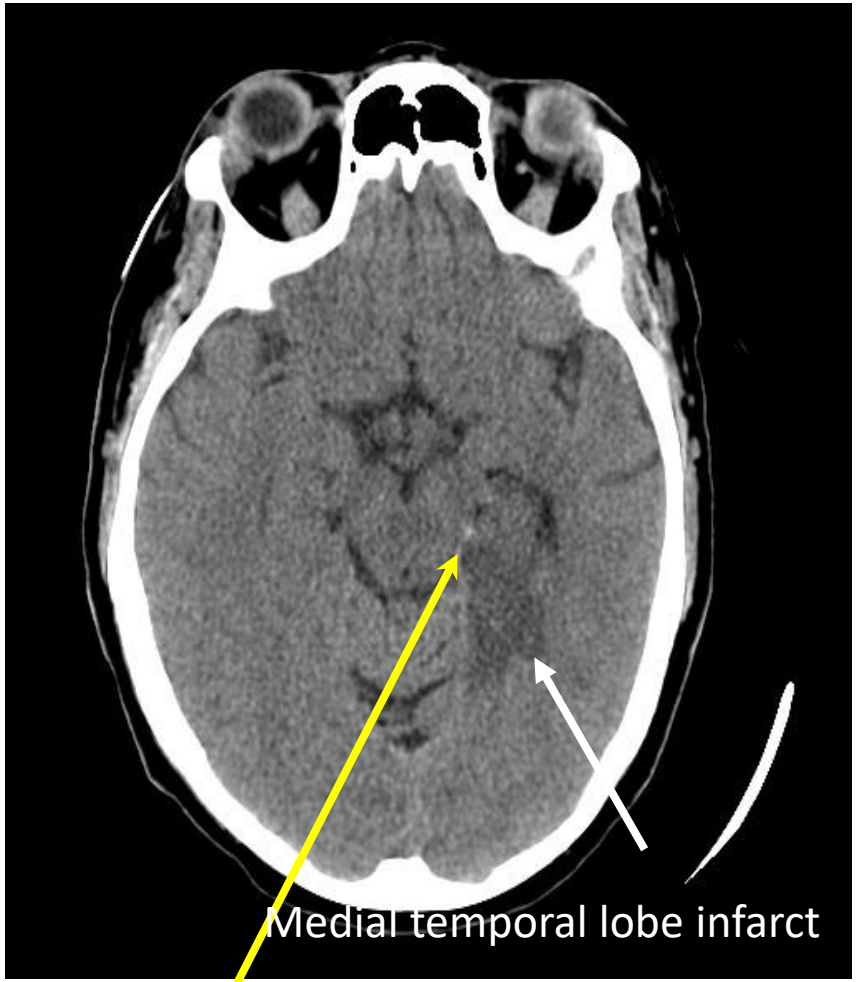


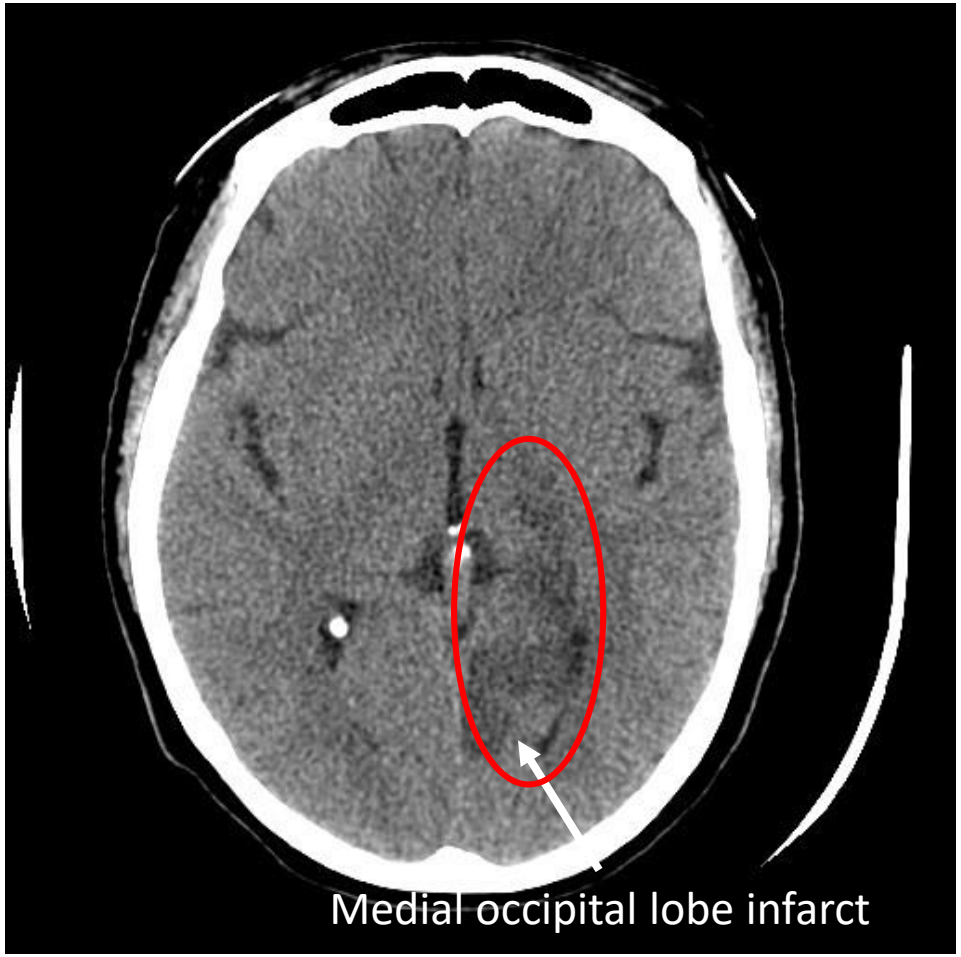
ACA (blue) covers the medial portion of the brain



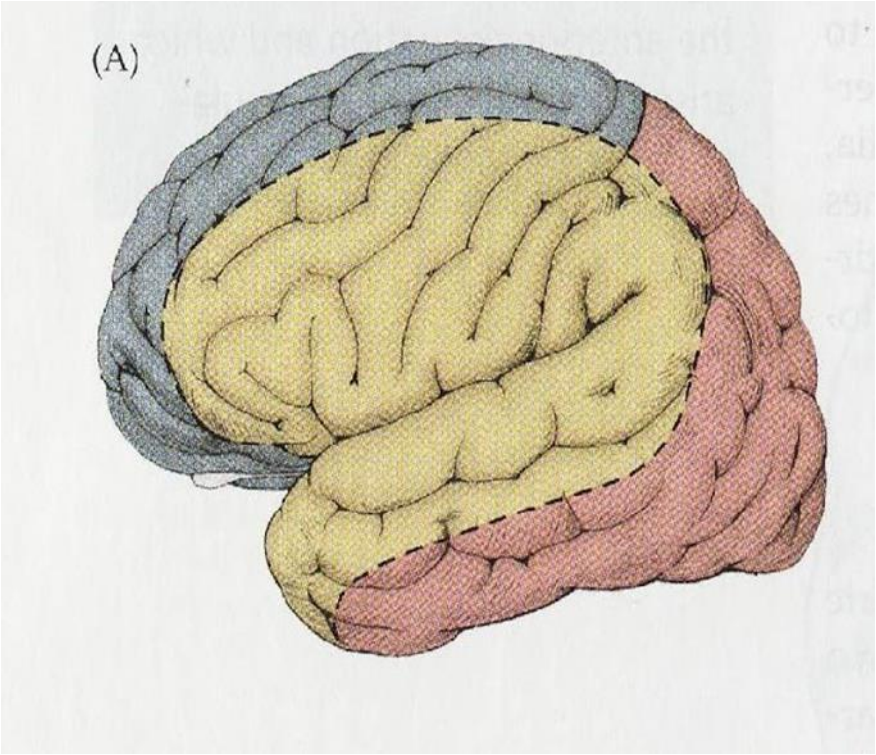


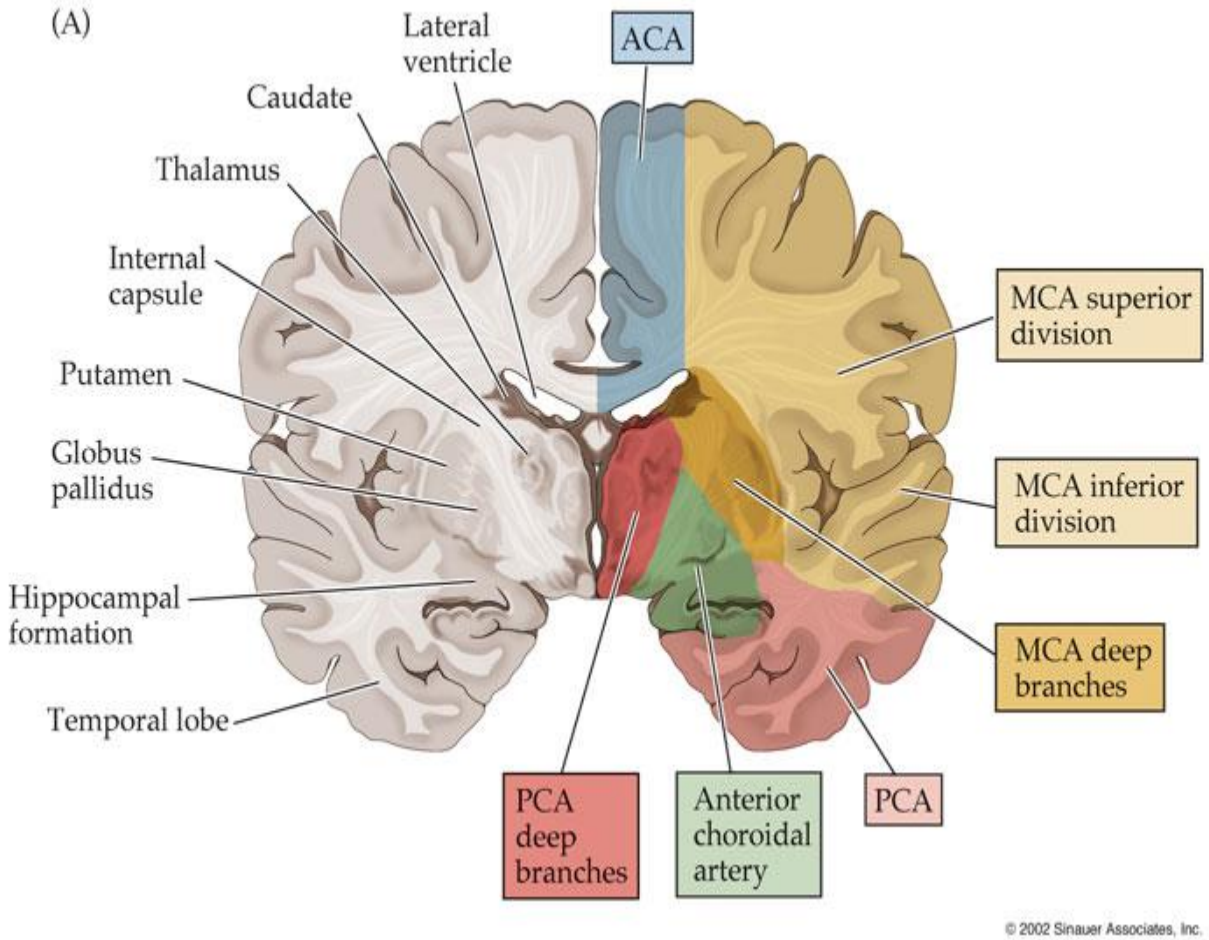
Left PCA infarction on CT





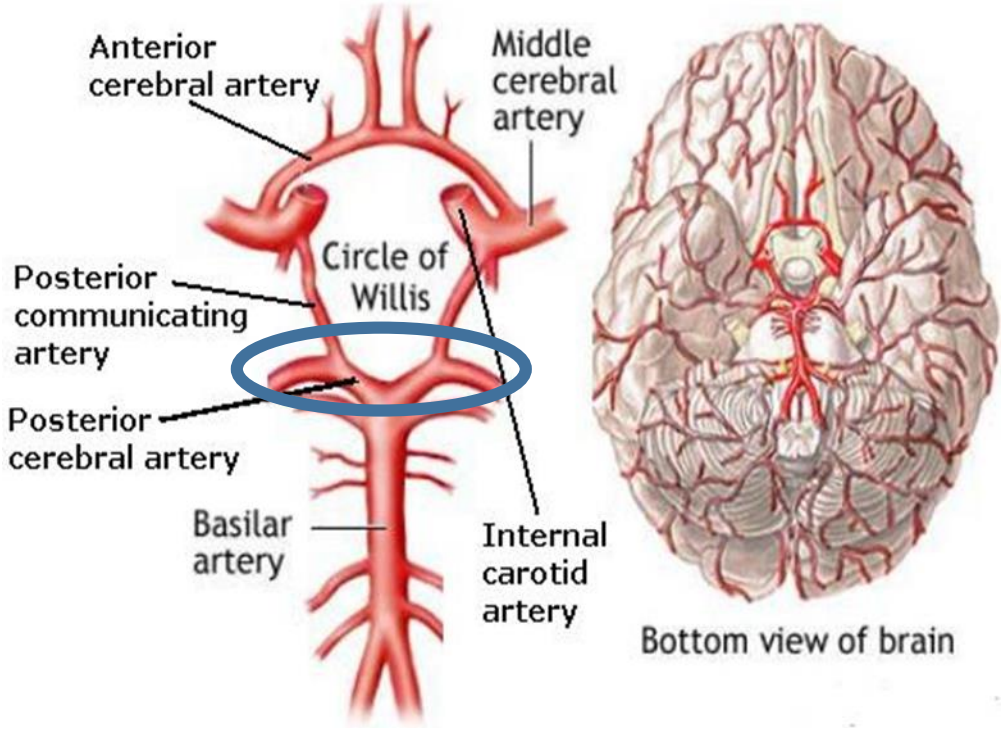
PCA (pink) covers the occipital and inferior/medial temporal lobe, and thalamus





PCA infarction

- Hemianopia
  - Sometimes **cortical blindness**, i.e. blind but confabulates because the patient is unaware they are blind
- Acute short term memory impairment
- Sometimes also aphasia
- Acute altered consciousness
- Sensory loss, often with minimal weakness



Brainstem stroke syndromes

- Some of the clinical features seen are:
  - **Crossed sensory findings (e.g. ipsilateral face and contralateral body numbness)**
  - **Crossed motor findings (ipsilateral face, contralateral body)**
  - **Gaze-evoked nystagmus**

Other findings in brainstem stroke

- Ataxia and vertigo, limb dysmetria
- Diplopia and eye movement abnormalities
- Dysarthria, dysphagia
- Tongue deviation
- Deafness (very rare)
- Locked-in syndrome (can’t move any limb, can’t speak, can sometimes blink

Midbrain stroke

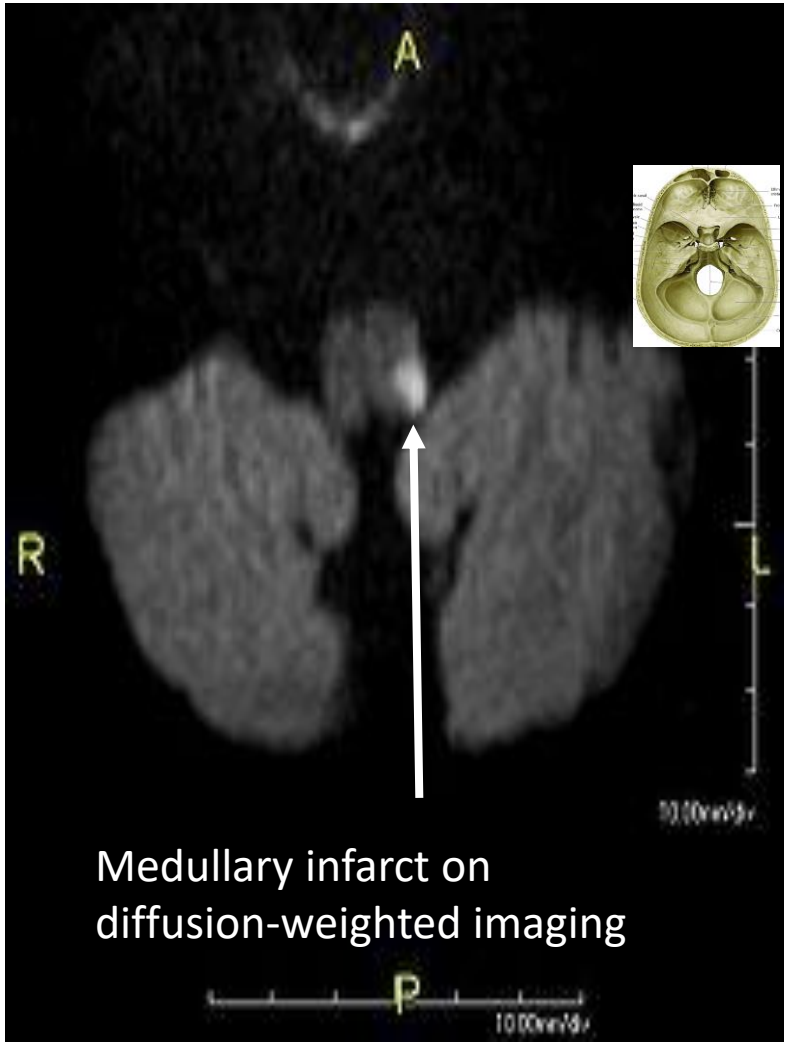
- Ipsilateral 3rd nerve palsy
- Contralateral hemiparesis of the arm and leg, sometimes with hemiplegia of the face
- Contralateral hemiataxia

Pontine stroke

- Ipsilateral signs:
  - Horner's syndrome
  - 6th or 7th nerve palsy (diplopia, whole side of face is weak)
  - Hearing loss (rare)
  - Loss of pain and temperature sense
- Contralateral signs:
  - Weakness in leg and arm
  - Loss of sensation in arm and leg
- Nystagmus, nausea

Medullary stroke

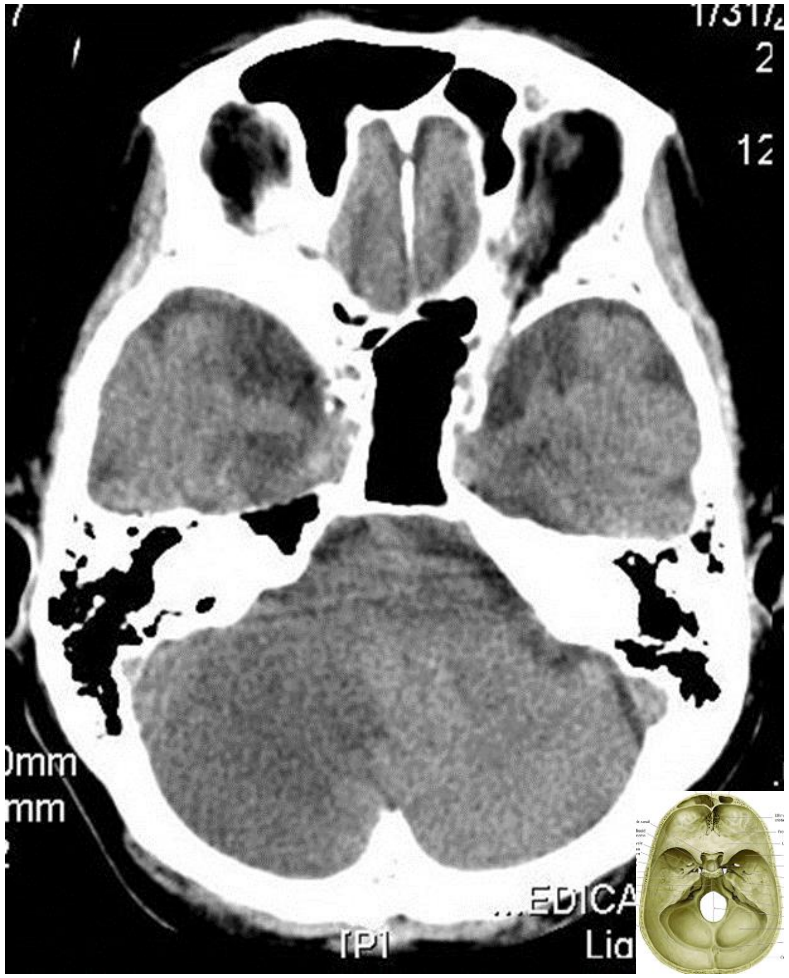
- Ipsilateral signs:
  - Tongue weakness
  - Sensory loss in face
  - Horner's syndrome
  - Ataxia
  - Palate weakness (dysphagia)
- Contralateral signs:
  - Weakness, sensory loss in arm and leg
- Nausea, nystagmus, dysphagia, dysarthria



Medullary infarct on diffusion-weighted imaging

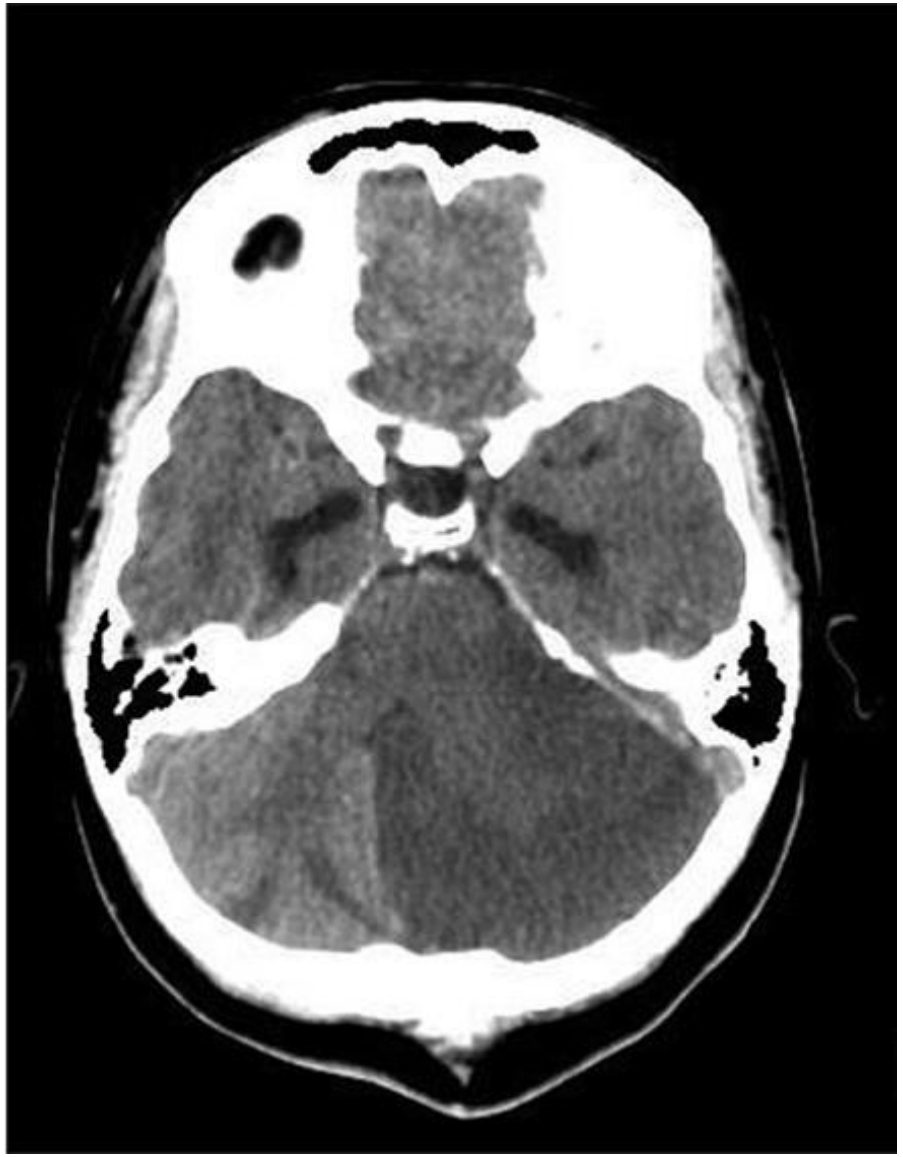
Cerebellar stroke

- Ataxia, vertigo, nausea, vomiting, dysarthria
- Often headache and nystagmus
- Can also have rapid deterioration in level of consciousness



Cerebellar infarction

- Infarction causes edema resulting in mass effect, herniation and compression of the fourth ventricle
- This can lead to rapid deterioration in level of consciousness
- Surgical decompression is often necessary in these circumstances



Lacunar stroke syndromes

- **Pure motor stroke** usually arises from infarction in the posterior limb of the internal capsule; course is often stuttering over hours to days:

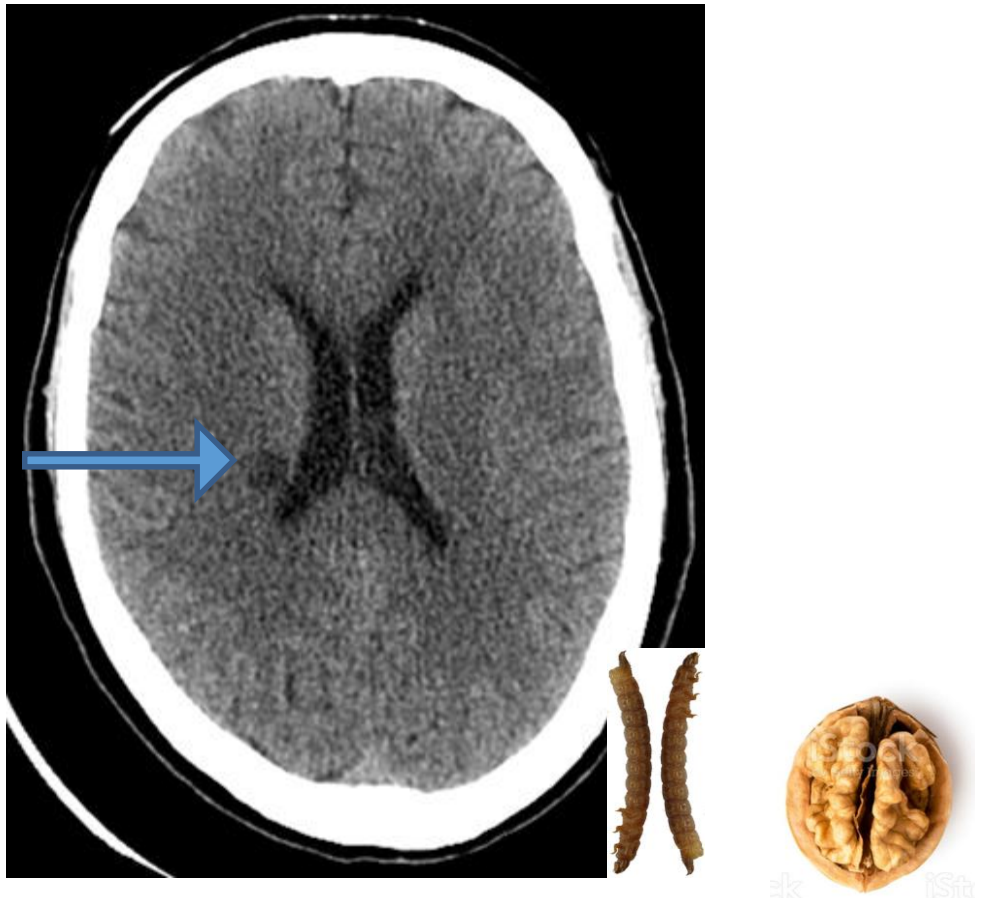
- **Pure sensory stroke** usually arises from thalamic infarction

Lacunar stroke syndromes

- **Sensorimotor stroke** can arise from infarcts at the junction between the thalamus and the internal capsule
- As the name implies, the symptoms consist of weakness and sensory loss with no visual field deficit, aphasia, neglect or other symptoms

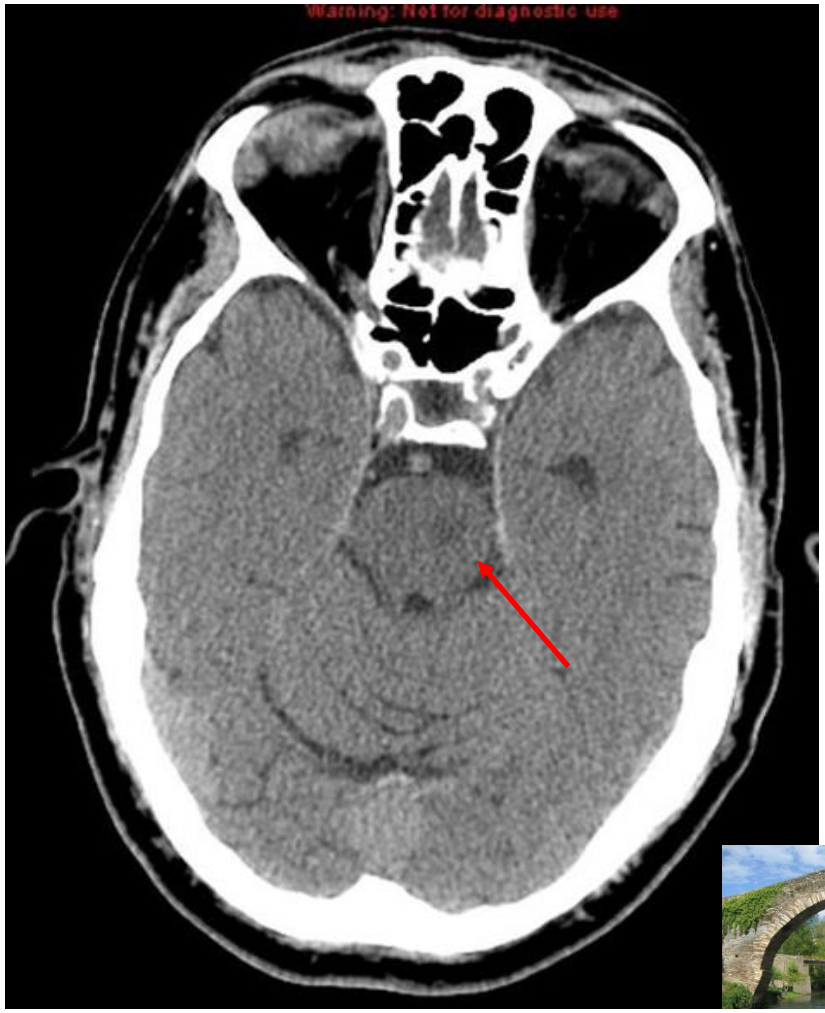
Lacunar stroke syndromes

- **Ataxic hemiparesis** often arises from infarction in the corona radiata
- Ataxia is unilateral and is in excess of the mild weakness found on exam



Lacunar stroke syndromes

- **Clumsy hand-dysarthria** is caused by infarction in the pons, but can also occur in corona radiata and the internal capsule
- Contralateral facial weakness with dysarthria and dysphagia occurs with contralateral hand weakness/ataxia, and sometimes weakness in the arm or leg



A brief word on stroke mimics

- **Stroke**: Maximum severity within a few minutes, typically
- **Migraine**: about 10 to 20 minutes and often symptoms such as paresthesia change in distribution or severity during that time
- **Seizure**: Altered LOC plus focal deficits such as aphasia sometimes point to a specific location in the brain for a seizure focus

- **Hyper- and hypoglycemia, and even electrolyte abnormalities** can present with speech impairments (usually dysarthria) but also focal motor deficits

- **Brain tumor** can present with sudden onset focal deficits, often reflecting seizure

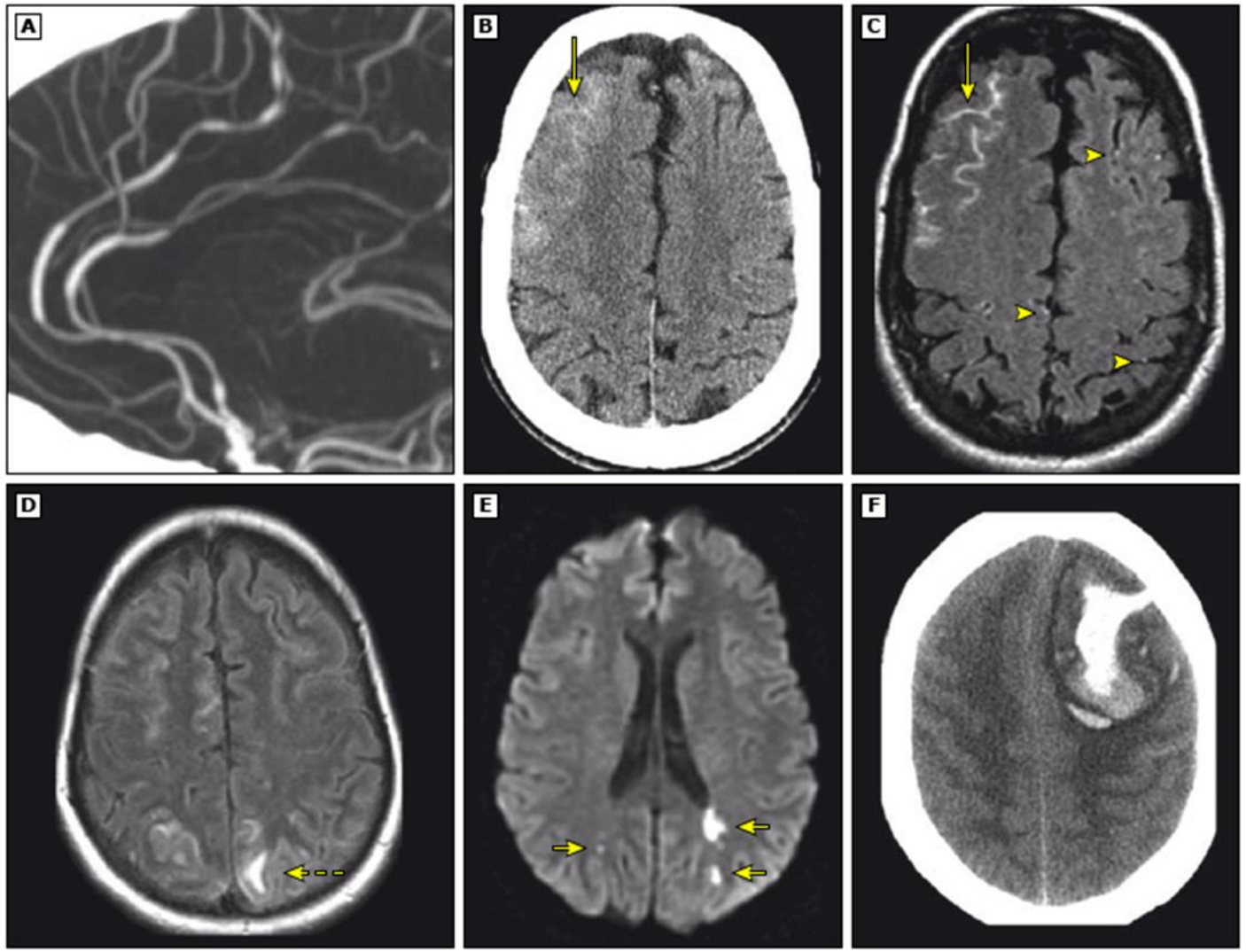
- **Transient global amnesia (TGA)** is rarely due to stroke and should resolve within 24 hours except for a short period of time that will always have no memory associated with it.

Stroke diagnoses that are rare and can share some of the clinical features of ischemic infarction

- **RCVS** (Reversible Cerebral Vasoconstriction Syndrome)
- **Cerebral venous sinus thrombosis**
- **PRES** (Posterior Reversible Encephalopathy Syndrome)

RCVS (Reversible Cerebral Vasoconstriction Syndrome)

- Thunderclap headache at onset
- Vasoconstriction of intracranial vessels
- Can result in both ischemic and hemorrhagic infarct
- Associated with nasal decongestants (pseudoephedrine), cannabis, SSRI



Cerebral venous sinus thrombosis

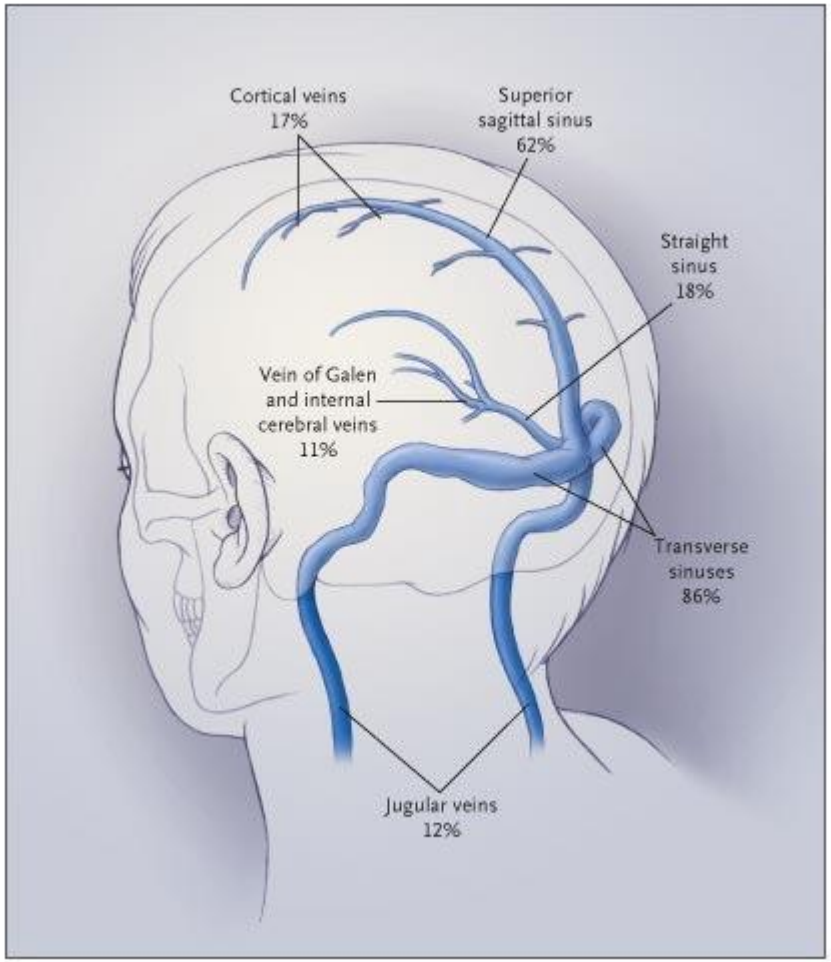
- Presents with headache, visual blurring, nausea, sometimes focal deficits, often seizure
  - Onset can be sudden, but often takes days to build up in headache intensity

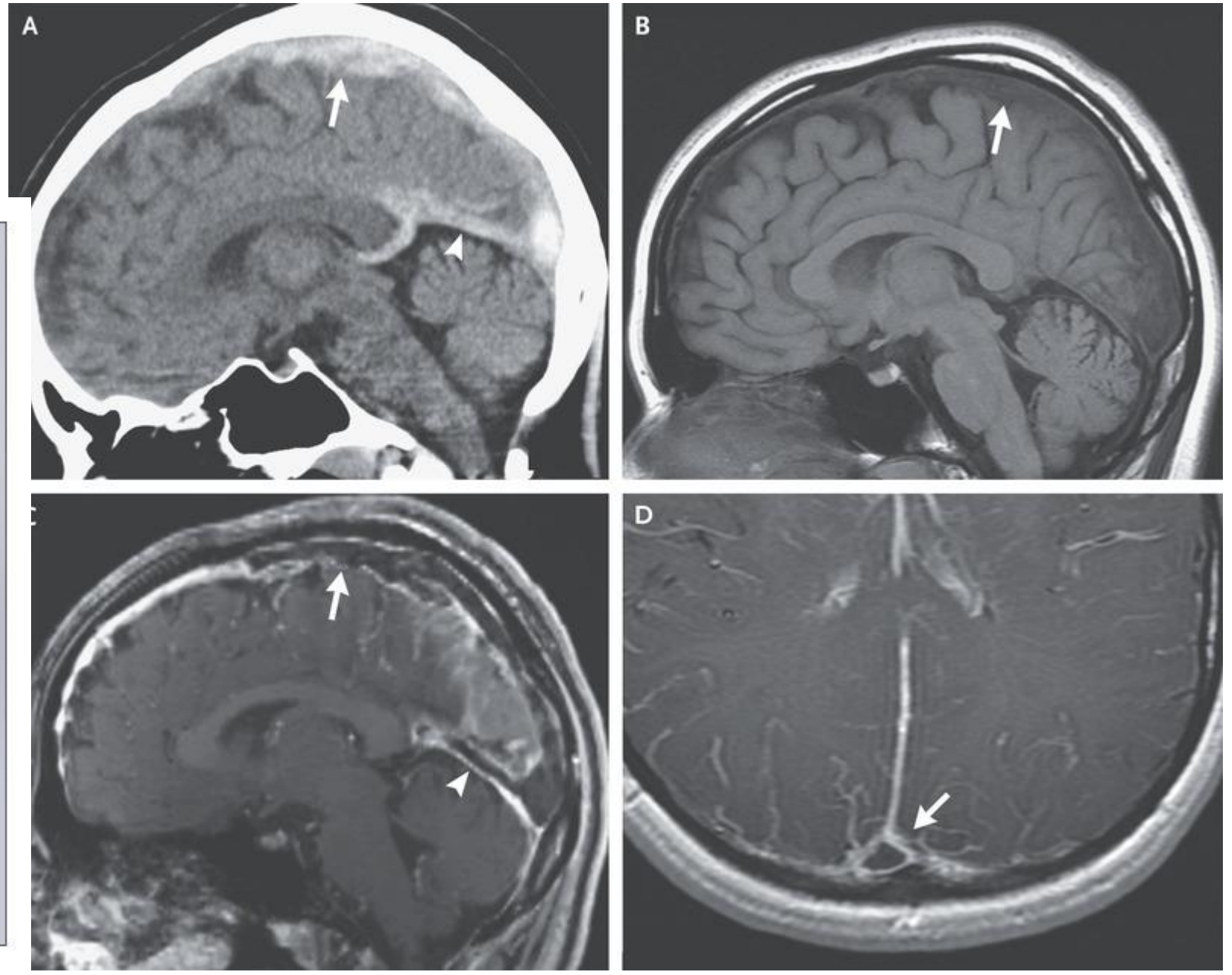
- Risk factors include: clotting disorders, pregnancy (and first few weeks post-partum), cancer, inflammatory bowel disease, collagen vascular disease

- Imaging with CT or MRI with CT or MR venogram can show thrombosis in cerebral veins, ischemic infarction, hemorrhage

- Treatment is with anticoagulation, even if there is small amount of hemorrhage!

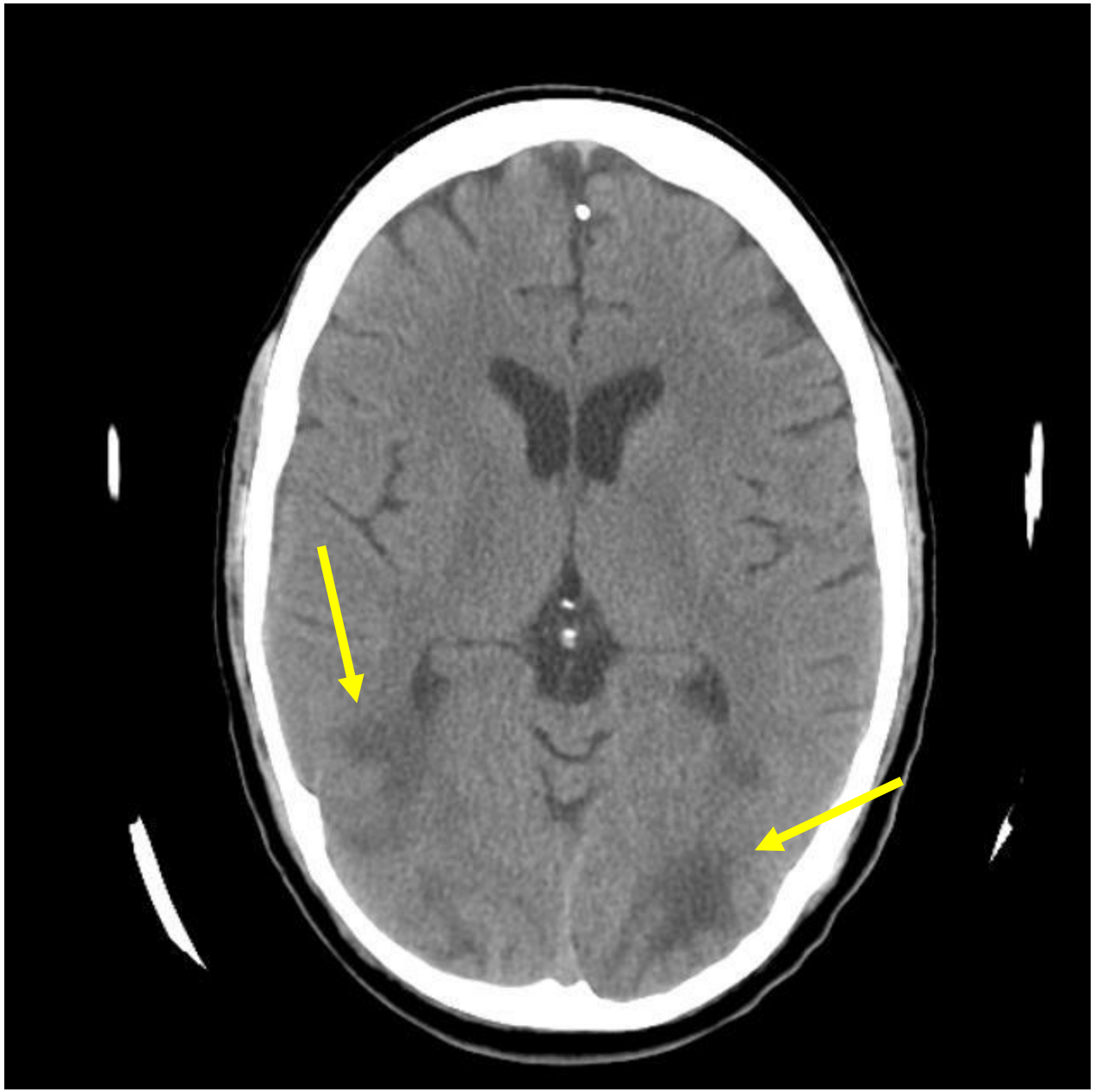
CVST


Cortical veins
17%
Superior
sagittal sinus
62%
Straight
sinus
18%
Vein of Galen
and internal
cerebral veins
11%
Transverse
sinuses
86%
Jugular veins
12%


A
B
D

PRES (Posterior Reversible Encephalopathy Syndrome)

- Generally occurs with sBP > 180 and usually over 200
  - Can occur in normotensive patients in the presence of other risk factors such as IVIG or chemotherapy (especialy bevacizumab)
- Vasogenic edema is prominent posteriorly, but can also occur anywhere in the brain
- Often presents with seizure, headache, blindness and sometimes focal deficit
- Treatment is BP control



JAMA Neurology | Original Investigation

Recrudescence of Deficits After Stroke

Clinical and Imaging Phenotype, Triggers, and Risk Factors

Mehmet A. Topcuoglu, MD; Esen Saka, MD, PhD; Scott B. Silverman, MD; Lee H. Schwamm, MD; Aneesh B. Singhal, MD

JAMA Neurol. 2017;74(9):1048-1055. doi:10.1001/jamaneurol.2017.1668
Published online August 7, 2017.

- Transient worsening of post-stroke deficits or reemergence of stroke-related deficits in the setting of toxic, metabolic, or physiological derangements is common but making this diagnosis can be difficult because it usually depends on MRI to prove there is no new infarction
- Common triggers include: infection, hypotension, hyponatremia, fever, stress, insomnia, benzodiazepine use
- If not sure about the diagnosis, call Stroke Service on call to discuss the case

If stroke mimic is suspected, play it safe

- It’s best to play it safe and if the patient has a significant deficit then either call Stroke on call at KHSC to discuss further or just send on ASP if appropriate on screening tests or your own exam
  - Stroke mimics can be very difficult to identify with certainty in the first 24 hours
  - It’s not uncommon for stroke mimics to be thrombolysed

- Fortunately, the risk of hemorrhagic transformation in stroke mimic patients who receive thrombolysis is very low

A few comments about thrombolysis

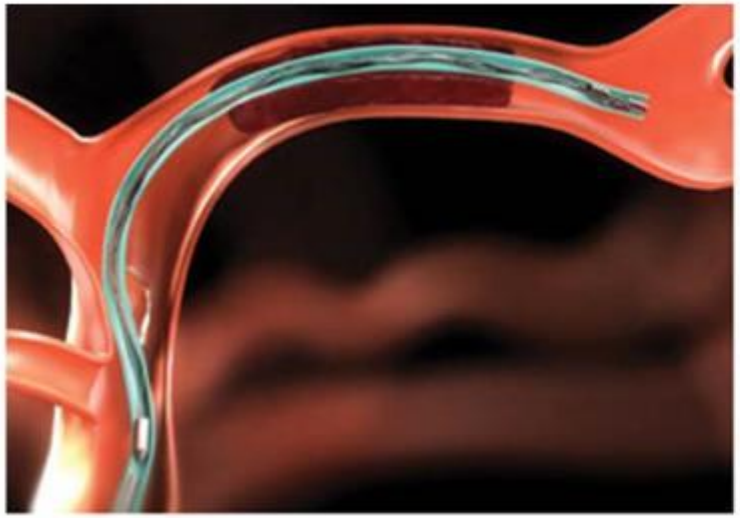
- Thrombolysis is evolving rapidly in Canada and worldwide and most thrombolysis-capable hospitals have switched from using **tissue plasminogen activator (tPA)** to **Tenecteplase (TNK)**

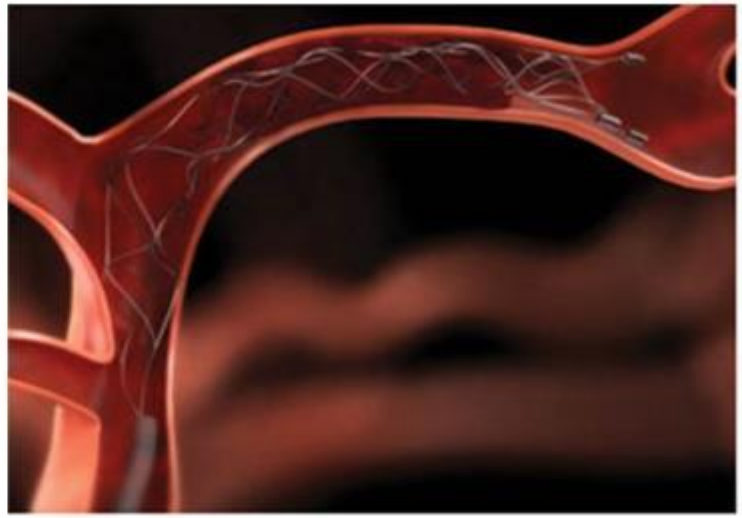
- Many recent studies have demonstrated that TNK is non-inferior to tPA for acute ischemic stroke

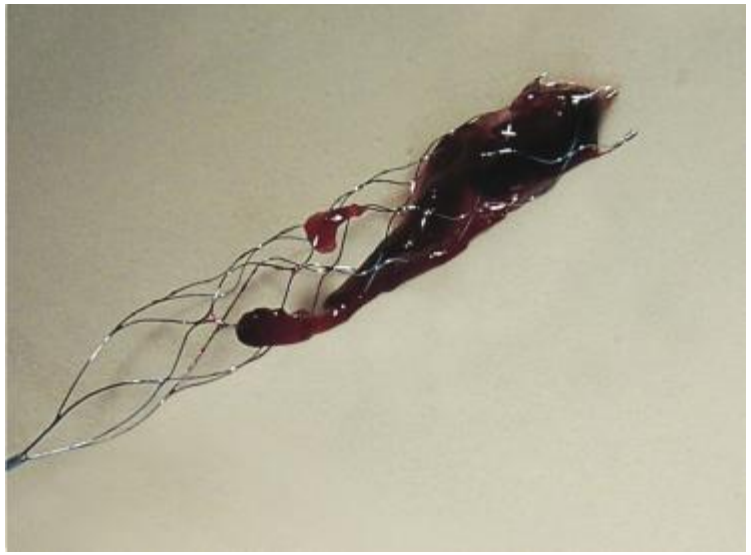
A few comments on EVT

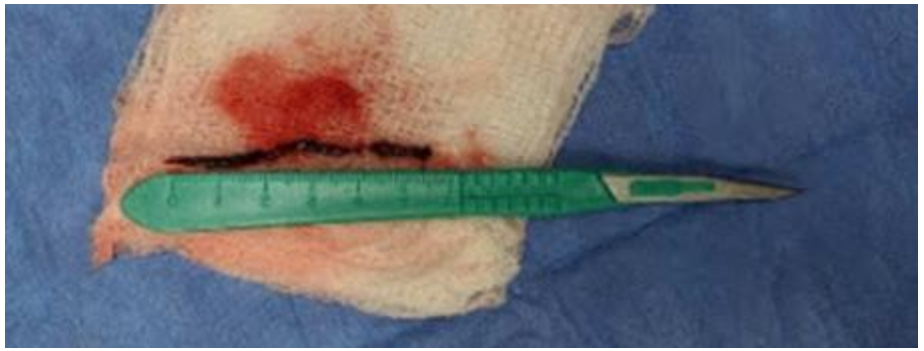
- Direct treatment using a catheter to effect removal or lysis of a thrombus from an extracranial or intracranial artery
  - Can also include intra-arterial tPA
  - Retrievable stent
  - Aspiration via catheter

Stent retriever









Even in cases of large established infarction, some patients may still benefit from EVT

JAMA | Original Investigation

Endovascular Thrombectomy for Large Ischemic Stroke Across Ischemic Injury and Penumbra Profiles

Amrou Sarraj, MD; Ameer E. Hassan, DO; Michael G. Abraham, MD; Santiago Ortega-Gutierrez, MD; Scott E. Kasner, MD; Muhammad Shazam Hussain, MD; Michael Chen, MD; Leonid Churilov, PhD; Hannah Johns, PhD; Clark W. Sitton, MD; Vignan Yogendrakumar, MD; Felix C. Ng, PhD; Deep K. Pujara, MBBS; Spiros Blackburn, MD; Sophia Sundararajan, MD; Yin C. Hu, MD; Nabeel A. Herial, MD; Juan F. Arenillas, MD, PhD; Jenny P. Tsai, MD; Ronald F. Budzik, MD; William J. Hicks, MD; Osman Kozak, MD; Bernard Yan, MBBS; Dennis J. Cordato, PhD; Nathan W. Manning, MBBS; Mark W. Parsons, PhD; Andrew Cheung, MBBS; Ricardo A. Hanel, MD; Amin N. Aghaebrahim, MD; Teddy Y. Wu, PhD; Pere Cardona Portela, MD; Chirag D. Gandhi, MD; Fawaz Al-Mufti, MD; Natalia Pérez de la Ossa, MD, PhD; Joanna D. Schaafsma, MD, PhD; Jordi Blasco, MD, PhD; Navdeep Sangha, MD; Steven Warach, MD; Timothy J. Kleinig, PhD; Faris Shaker, MBChB; Faisal Al Shaibi, MD; Gabor Toth, MD; Mohammad A. Abdulrazzak, MD; Gagan Sharma, MS; Abhishek Ray, MD; Jeffrey Sunshine, MD, PhD; Amanda Opaskar, MD; Kelsey R. Duncan, MD; Wei Xiong, MD; Edgar A. Samaniego, MD; Laith Maali, MD; Colleen G. Lechtenberg, MD; Arturo Renú, MD; Nirav Vora, MD; Thanh Nguyen, MD; Johanna T. Fifi, MD; Stavropoula I. Tjoumakaris, MD; Pascal Jabbour, MD; Georgios Tsivgoulis, MD; Vitor Mendes Pereira, MD; Maarten G. Lansberg, MD; Michael DeGeorgia, MD; Cathy A. Sila, MD; Nicholas Bambakidis, MD; Michael D. Hill, MD; Stephen M. Davis, MD; Lawrence Wechsler, MD; James C. Grotta, MD; Marc Ribo, MD; Greg W. Albers, MD; Bruce C. Campbell, PhD; for the SELECT2 Investigators

JAMA. 2024;331(9):750-763. doi:10.1001/jama.2024.0572
Published online February 7, 2024.

SELECT2 study

- Patients 18 to 85 years of age
- Premorbid mRS 0-1
- ASPECTS 3-5 or core volume 50 mL or greater
- Trial stopped early for efficacy after 178 patients had EVT and 174 had medical care
- 20% in EVT group had mRS 0-2 at 90 d vs 7% in medical care group
- Published in NEJM February 10, 2023

Figure 1. Endovascular Thrombectomy Treatment Effect on mRS Score Distribution at 90-Day Follow-Up Across Various Imaging Strata, Reported Using Adjusted Generalized Odds Ratio

Measure	No. of patients	mRS score, median (IQR)		aGenOR (95% CI)	*P* value for interaction
		Thrombectomy	Medical management		
ASPECTS					
0-2	19	6 (5-6)	6 (5-6)	1.52 (0.94-2.46)	
3-5	277	4 (3-6)	5 (4-6)	1.82 (1.40-2.35)	.80
6-10	40	5 (3-6)	6 (4-6)	1.55 (0.81-2.98)	
3	73	4 (3-6)	6 (4-6)	1.71 (1.04-2.81)	
4	88	4 (3-6)	5 (4-6)	2.01 (1.19-3.40)	.80
5	116	3 (2-6)	4 (3-6)	1.85 (1.22-2.79)	
Core volume, mL					
<70	156	3 (2-6)	4 (3-6)	1.78 (1.24-2.56)	
≥70	180	5 (4-6)	6 (4-6)	1.63 (1.23-2.16)	.92
<100	236	4 (2-6)	5 (4-6)	1.91 (1.44-2.55)	
≥100	100	6 (4-6)	6 (5-6)	1.41 (0.99-2.02)	.29
<150	296	4 (3-6)	5 (4-6)	1.82 (1.42-2.34)	
≥150	40	6 (4-6)	6 (5-6)	1.47 (0.84-2.56)	.29
Mismatch ratio ≥1.2 and volume ≥10 mL					
No	29	4 (4-6)	5 (4-6)	2.11 (0.97-4.58)	
Yes	307	4 (3-6)	5 (4-6)	1.75 (1.38-2.24)	.96
Mismatch ratio ≥1.8 and volume ≥15 mL					
No	120	5 (4-6)	6 (4-6)	1.68 (1.17-2.40)	
Yes	216	4 (2-6)	5 (4-6)	1.79 (1.33-2.42)	.92

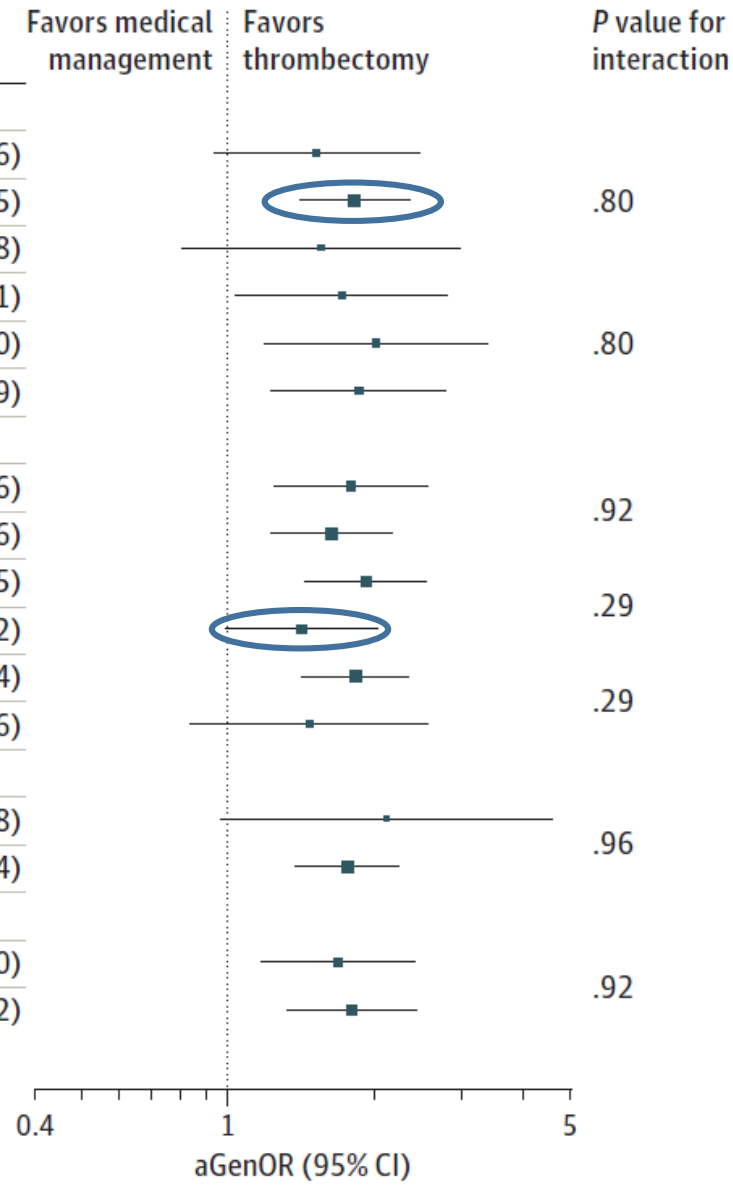


Figure 2. Distribution of Modified Rankin Scale Score at 90-Day Follow-Up in the Study Population (Intention to Treat)

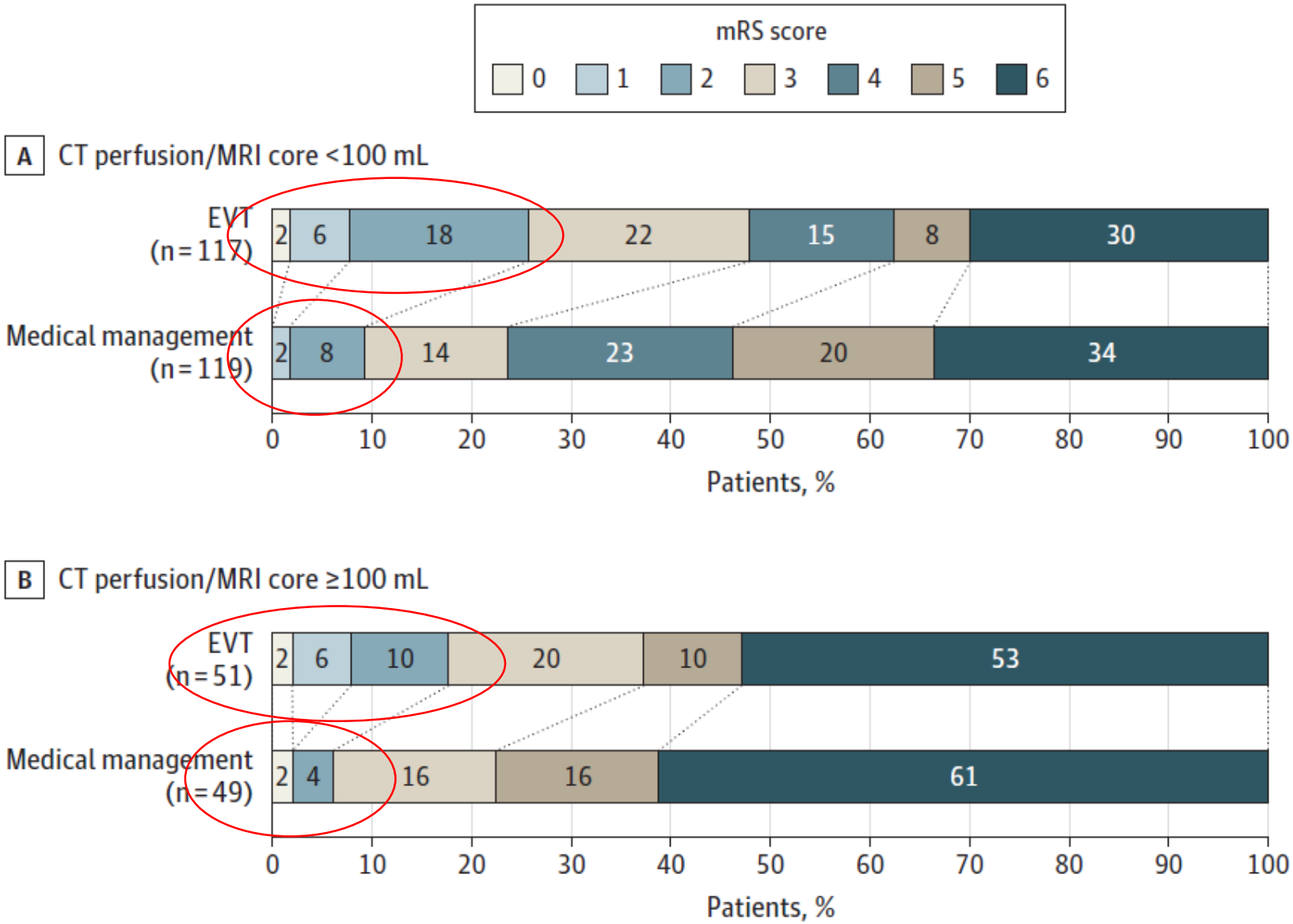
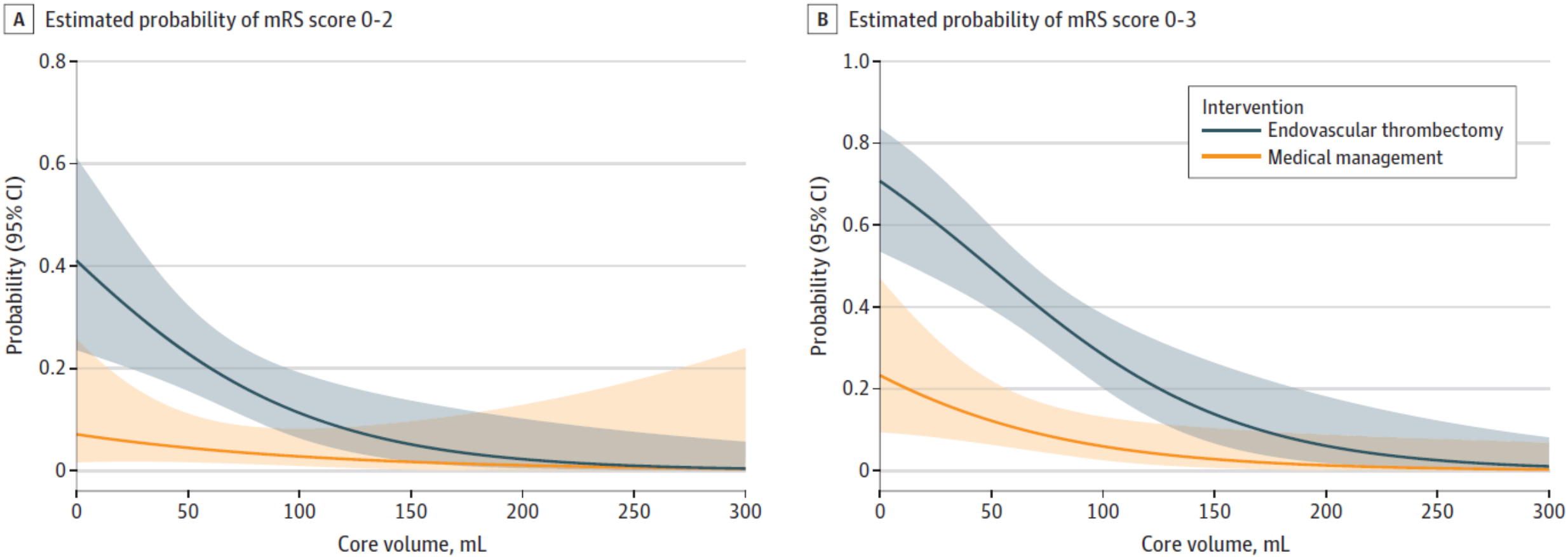


Figure 3. Association of Increasing CT Perfusion/MRI Core Volume and Functional Outcomes at 90-Day Follow-Up in Patients Receiving Endovascular Thrombectomy and Medical Management



TIA Management and Complications

- Canadian Stroke Best Practices Recommendations:

https://www.strokebestpractices.ca/recommendations/acute-stroke-management/emergency-department-evaluation-and-management

- TIA management hinges on history, examination, and imaging including vascular assessment

Investigations and Treatment for TIA/Minor Stroke

- CT head + CT angiography (aortic arch to Circle of Willis), or
- CT head + carotid Doppler ultrasound if CTA not available
- ECG, bloodwork (non-fasting lipid panel, HbA1c, routine chemistry and CBC)
- Dual antiplatelet therapy:
  - Load ASA 160 mg + Clopidogrel 300 mg, then ECASA 81 mg OD + clopidogrel 75 mg OD for 21 days, then just ECASA 81 mg OD thereafter
- If systolic BP is over 220, it's reasonable to lower sBP by no more than 25% over the first 24 hours

CT angiography is ideal, carotid Doppler will do if that's what is available

- CT angiography is generally more accurate than carotid Doppler ultrasound
- However, if there is a large amount of calcified atherosclerotic plaque at the ICA origin, it can be very difficult to assess the degree of stenosis on CTA, and in these rare cases Doppler is often recommended by the radiologist

Is it necessary to do MRI in every TIA patient?

- No! MRI can be helpful if you aren't sure if a patient has stroke or an alternative diagnosis.

- For example, if an intoxicated patient presents with acute onset persistent vertigo which isn't obviously benign paroxysmal positional vertigo or vestibular neuritis, MRI can be helpful to clarify if there is any acute infarction.

- History and examination yield far more insight than imaging in most TIA cases

What if the patient seizes while being worked up for TIA/stroke?

- Seizure occurs in about 1 to 3% of all acute stroke admissions in Ontario
- Seizure is more likely in patients with acute intracerebral hemorrhage or cortical infarction
- Treat with lorazepam, can also consider levetiracetam or other longer-acting anticonvulsants
- Contact Stroke Service at KHSC for further advice, and possibly transfer
  - Kingston General Hospital is the only site in southeastern Ontario that has EEG

What if the patient is fluctuating or deteriorating?

- Call Stroke Service at KHSC

- Patients with lacunar infarction often fluctuate, with recurrent symptoms being stereotyped
  - Need to ensure that there is no critical carotid stenosis, or symptomatic intracranial atherosclerotic disease on CT angiography

- If alertness is deteriorating in a patient with a large infarct, the differential diagnosis includes seizure, malignant infarction, and lateralized periodic discharges (EEG shows focal spikes and sharp waves periodically at 1 to 2 Hz)

Thanks for the great work that you are doing in Perth and Smiths Falls!

- If you have any questions, please reach out to me at:

albert.jin@kingstonhsc.ca