Brockville Stroke School

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Disclosures

- I have no commercial interests or disclosures.
- There will not be any payment to me for this presentation.

Part 1 Outline

- **Quick neurological examination** of stroke inpatients.
- How to read a **noncontrast CT scan**.
- What clinical symptoms, findings and course to expect with different types of **ischemic stroke**.
- Special considerations in **hemorrhagic stroke**.

Part 2 Outline

- **Stroke Unit Care:**
  - Seizure
  - Fever
  - DVT prophylaxis
  - Mobility
  - Continence and UTI
  - Nutrition
  - Aspiration, pneumonia and oral care

Part 3 Outline

- Doing the right tests for each **stroke subtype**
  - Large artery atherosclerotic disease
  - Small vessel ischemic disease
  - Cardioembolism
  - Other
  - Cryptogenic
- What should you put in to your **discharge summary**?

Approach to Neurological Exam

- 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

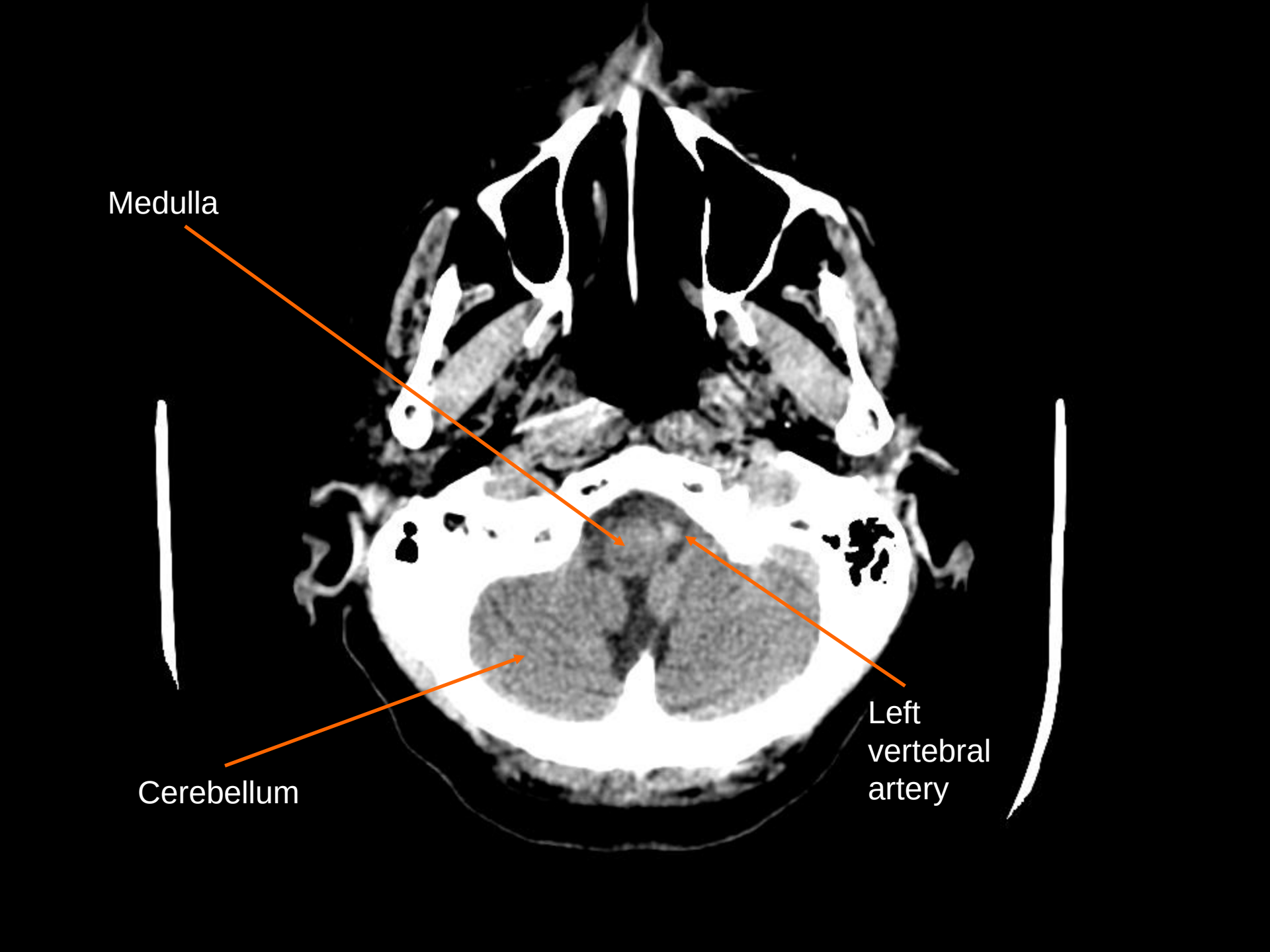
How to read a CT scan

We will learn the following:

- Recognize basic anatomical structures on a plain CT head
- Recognize acute thrombus in the MCA
- Recognize acute ischemic stroke

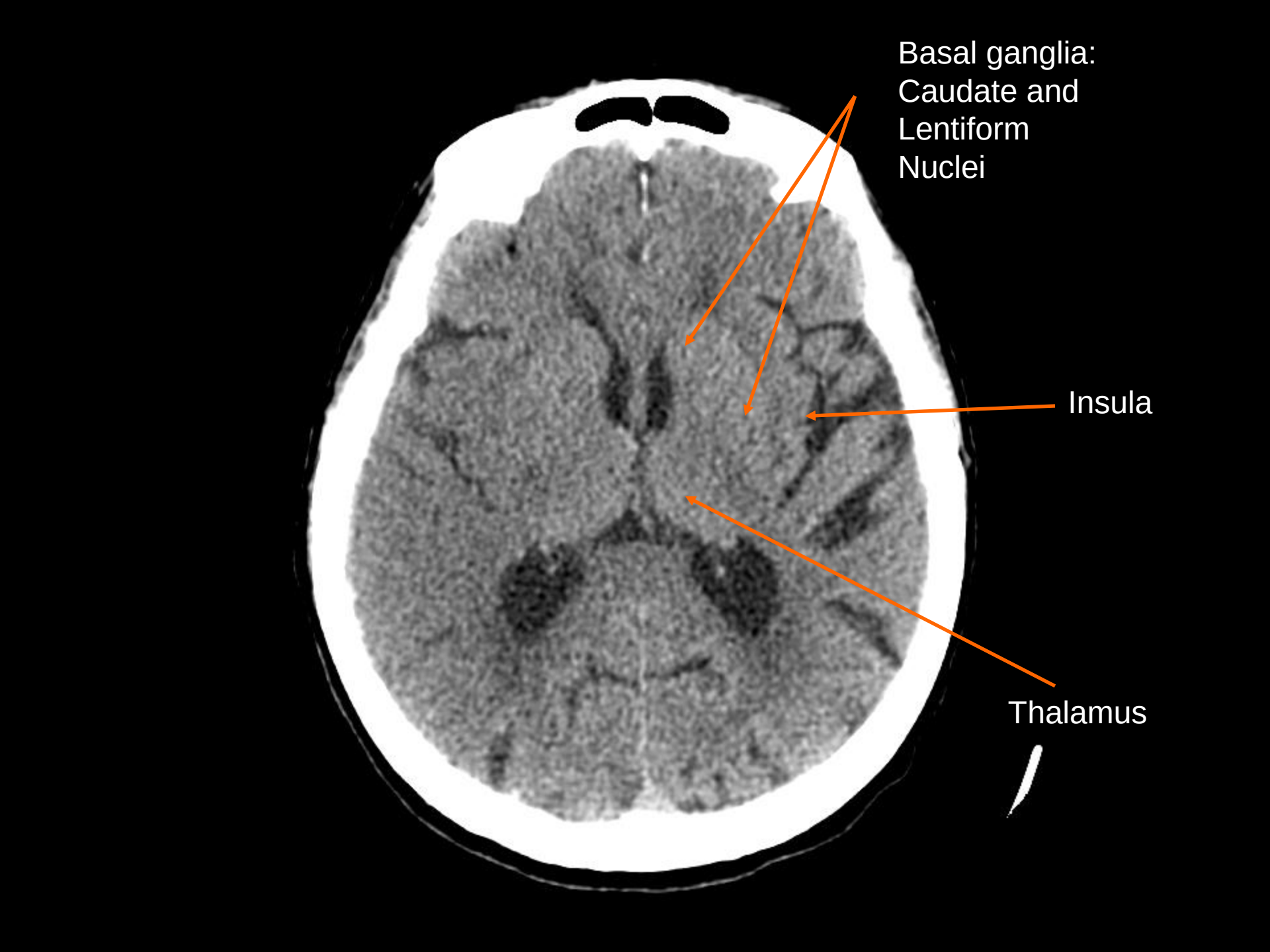
Reading a plain CT head

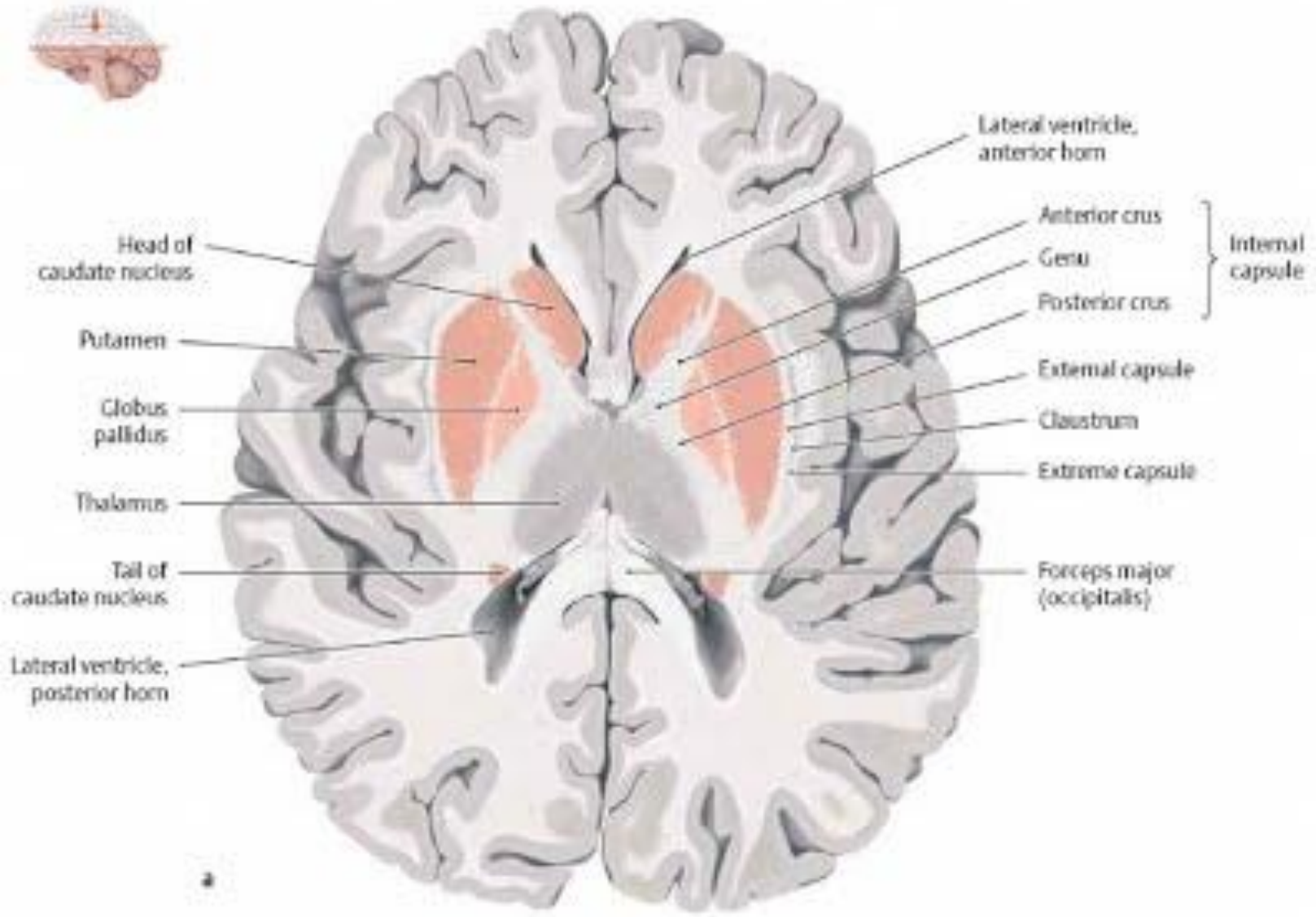
- Know the following levels on an axial CT:
  - Medulla, Cerebellum, and Vertebral Arteries
  - Pons, and Basilar Artery
  - Midbrain, and Proximal Middle Cerebral Arteries
  - Basal ganglia and Insula
  - Corona radiata
  - Centrum semiovale

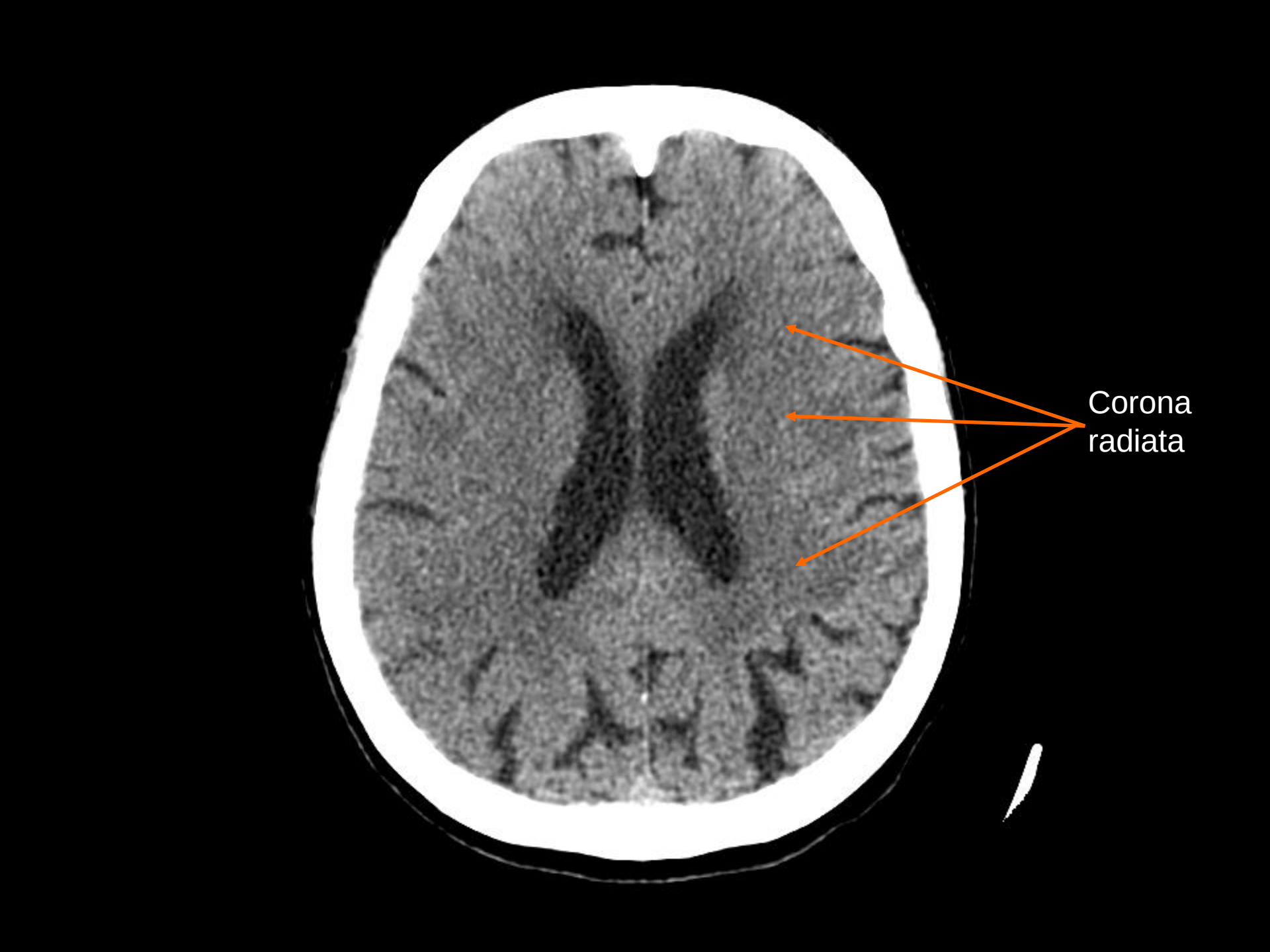

Medulla
Cerebellum
Left
vertebral
artery

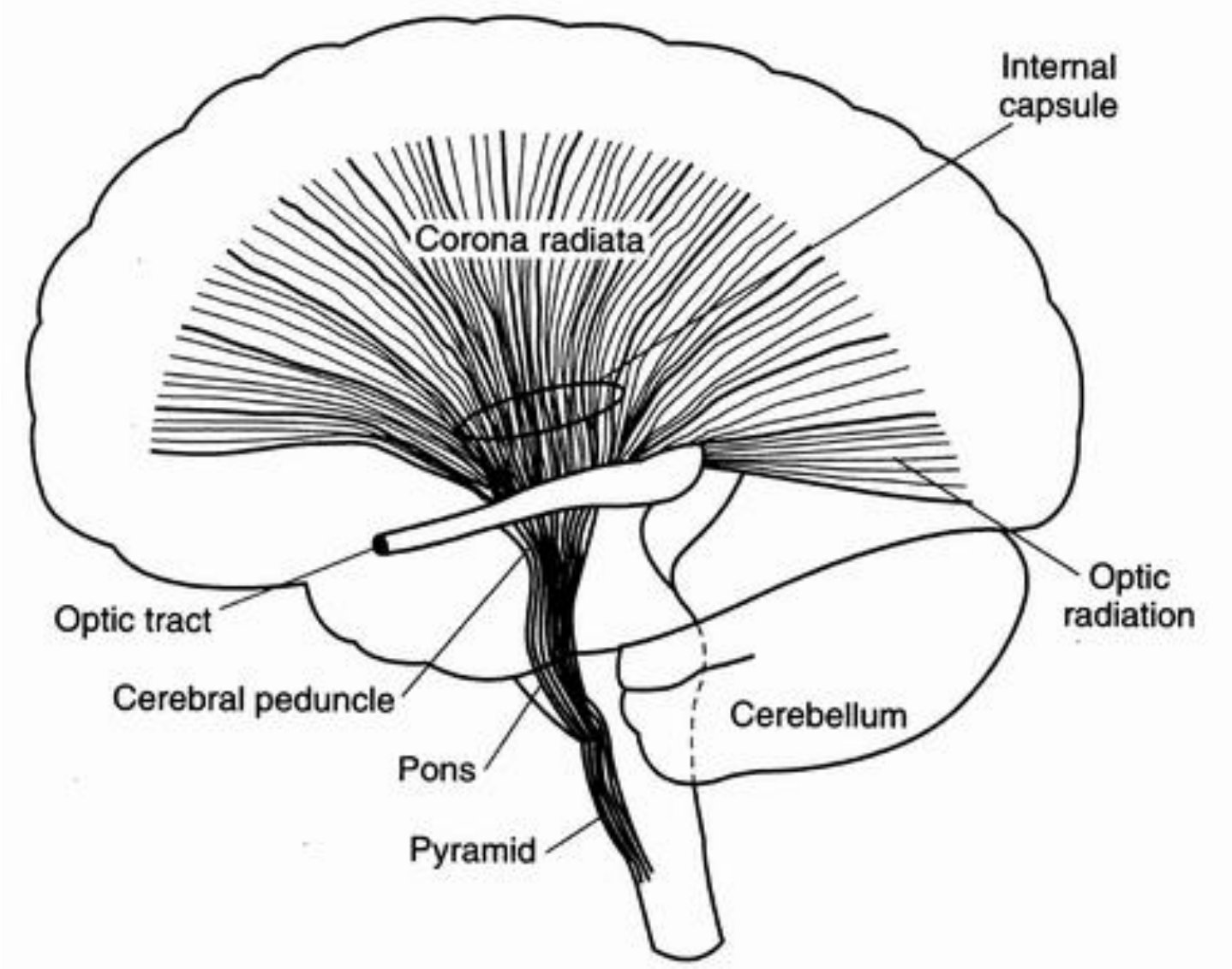

Pons
Basilar artery

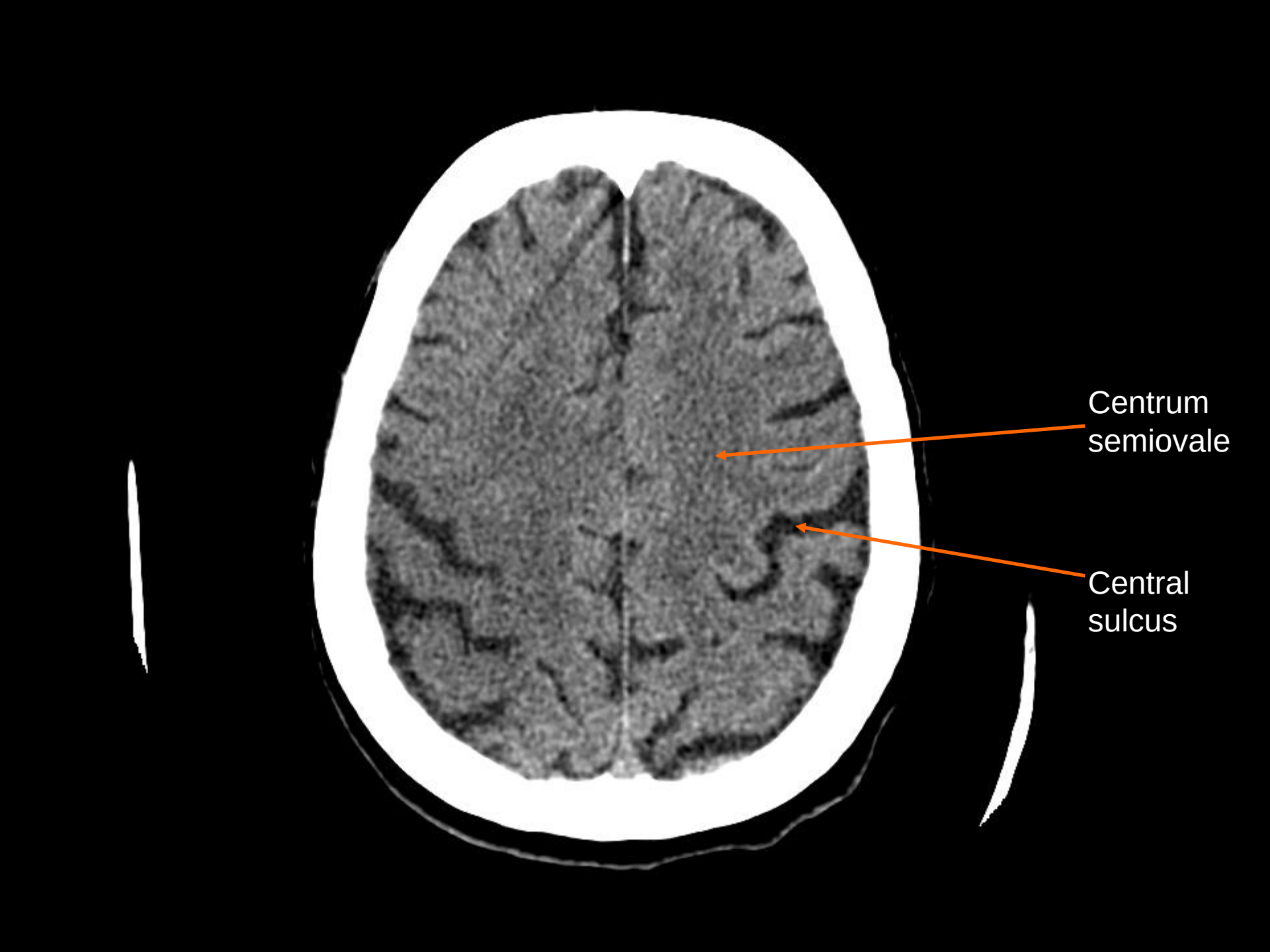

Midbrain
Middle
cerebral artery


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

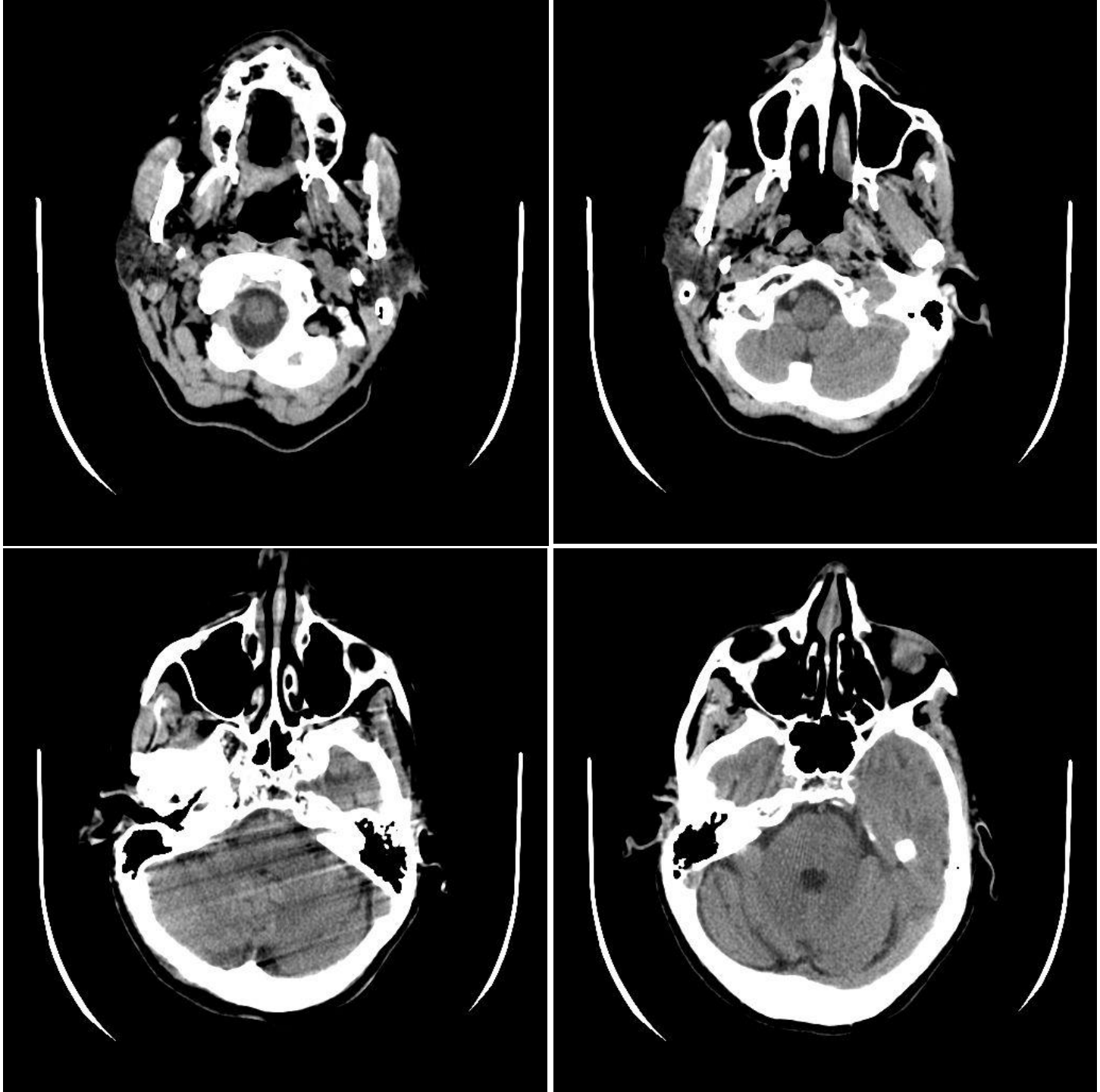

Corona
radiata

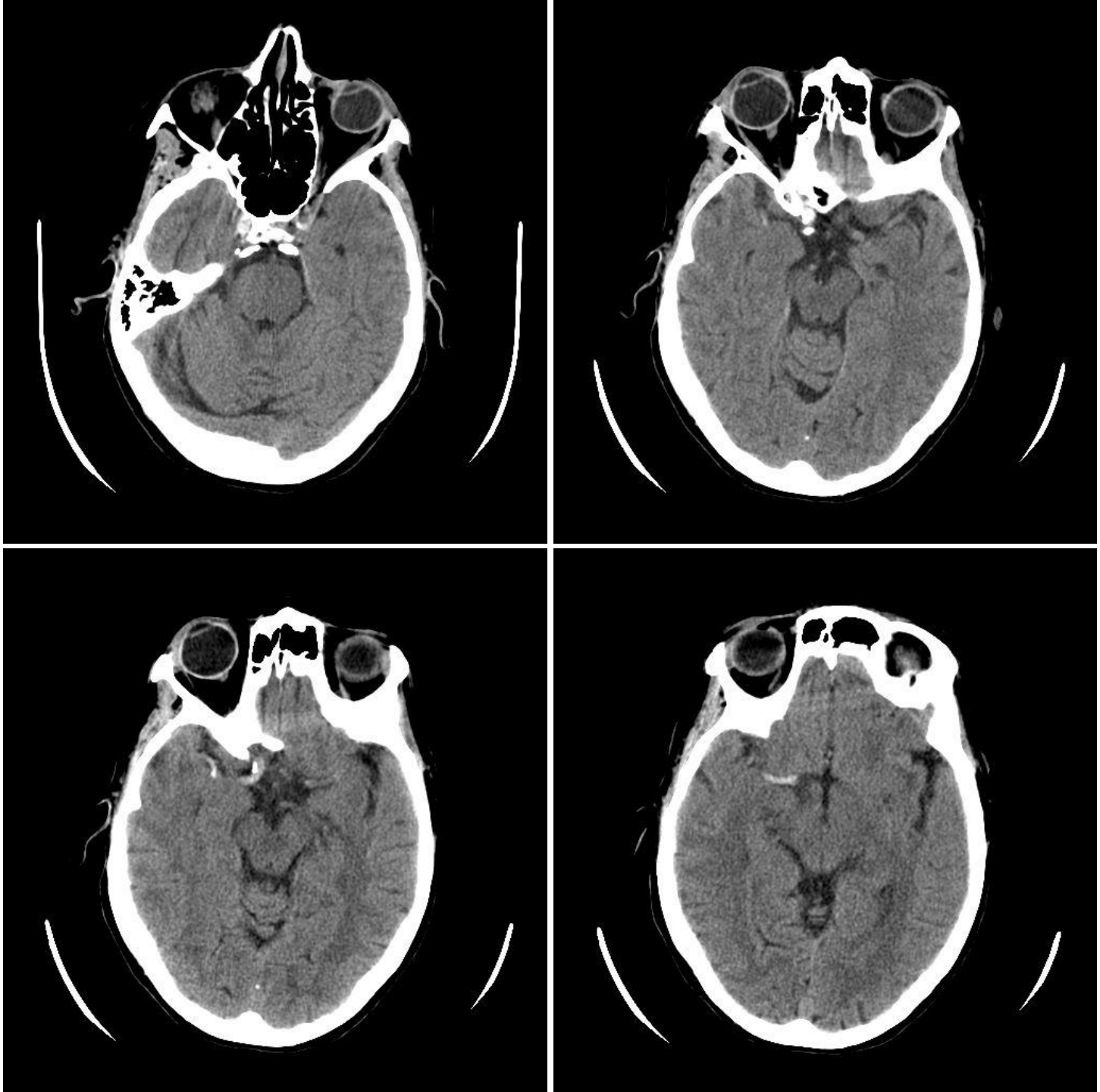

Internal capsule
Corona radiata
Optic radiation
Optic tract
Cerebral peduncle
Cerebellum
Pons
Pyramid

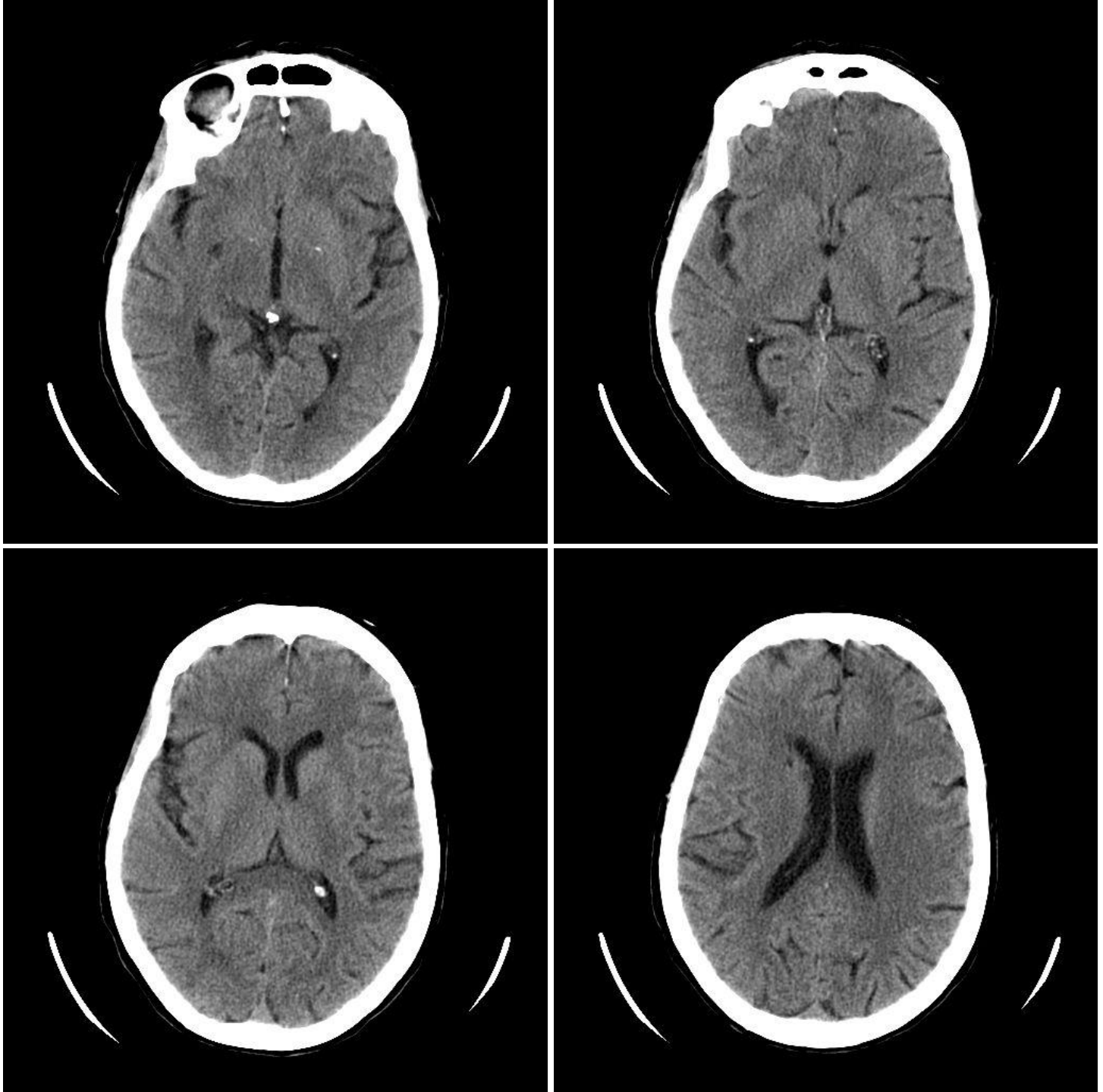

Centrum semiovale
Central sulcus

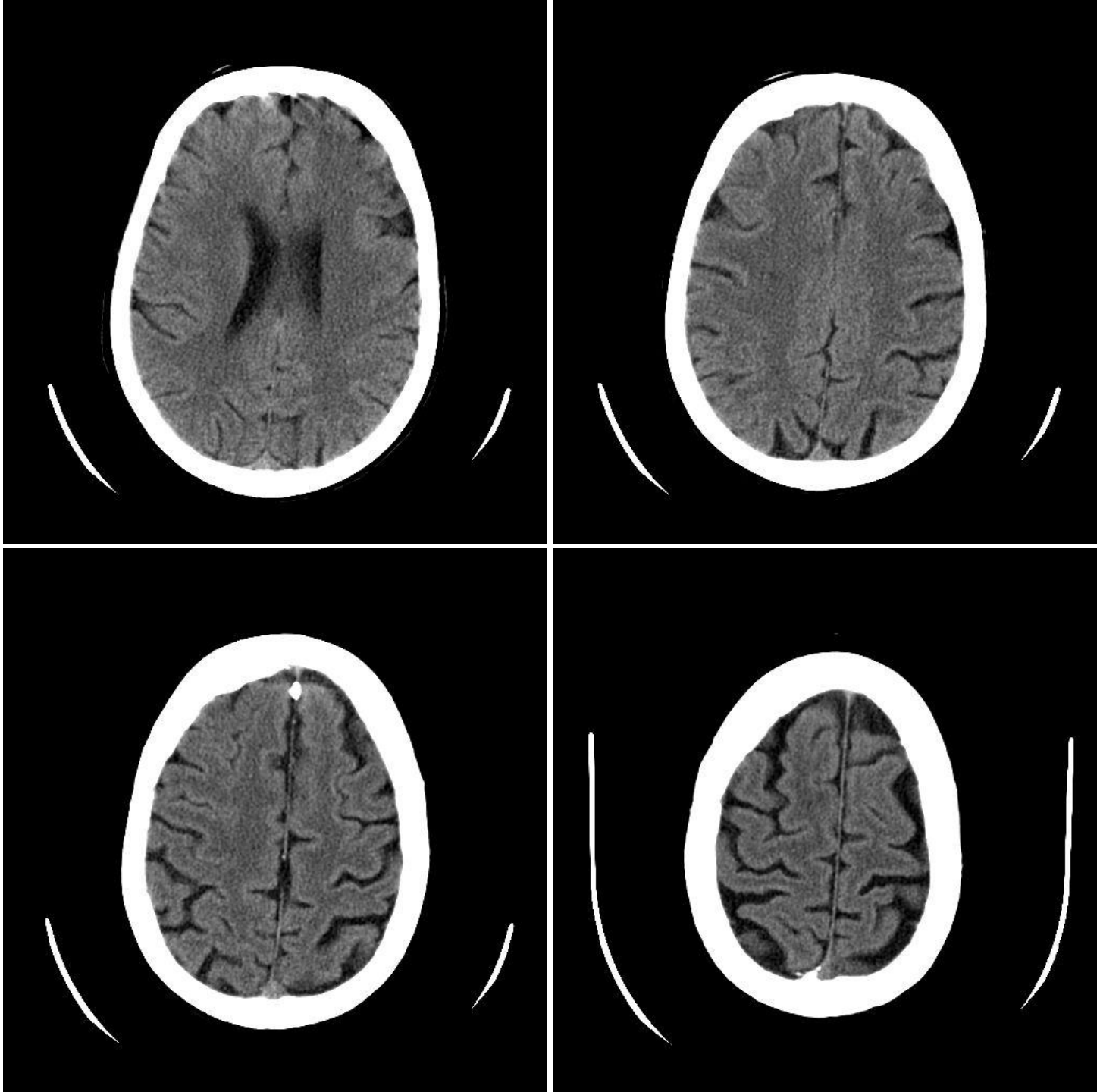
Recognize acute thrombus

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





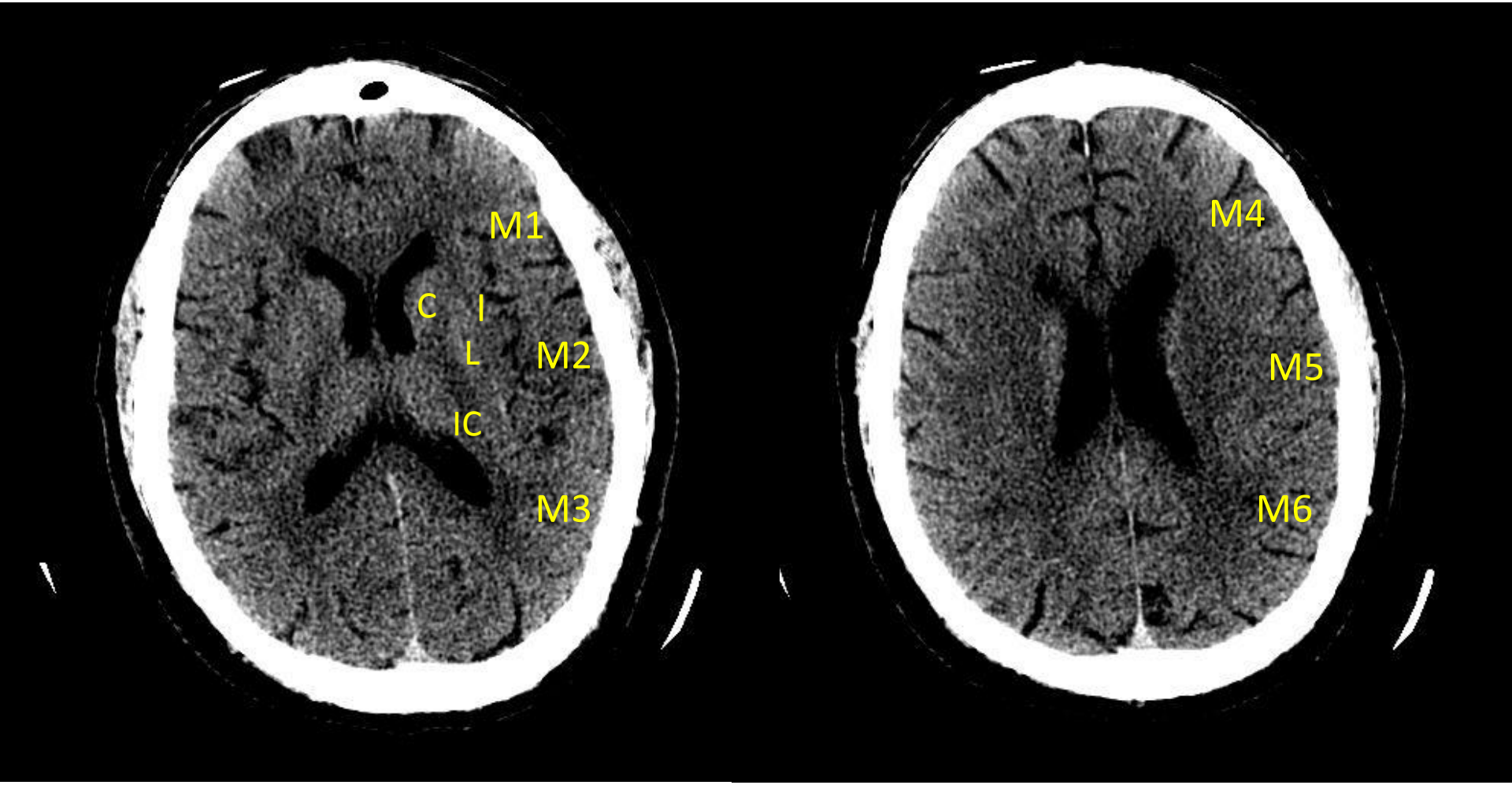




Detecting early cerebral ischemia on CT scan

- 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)

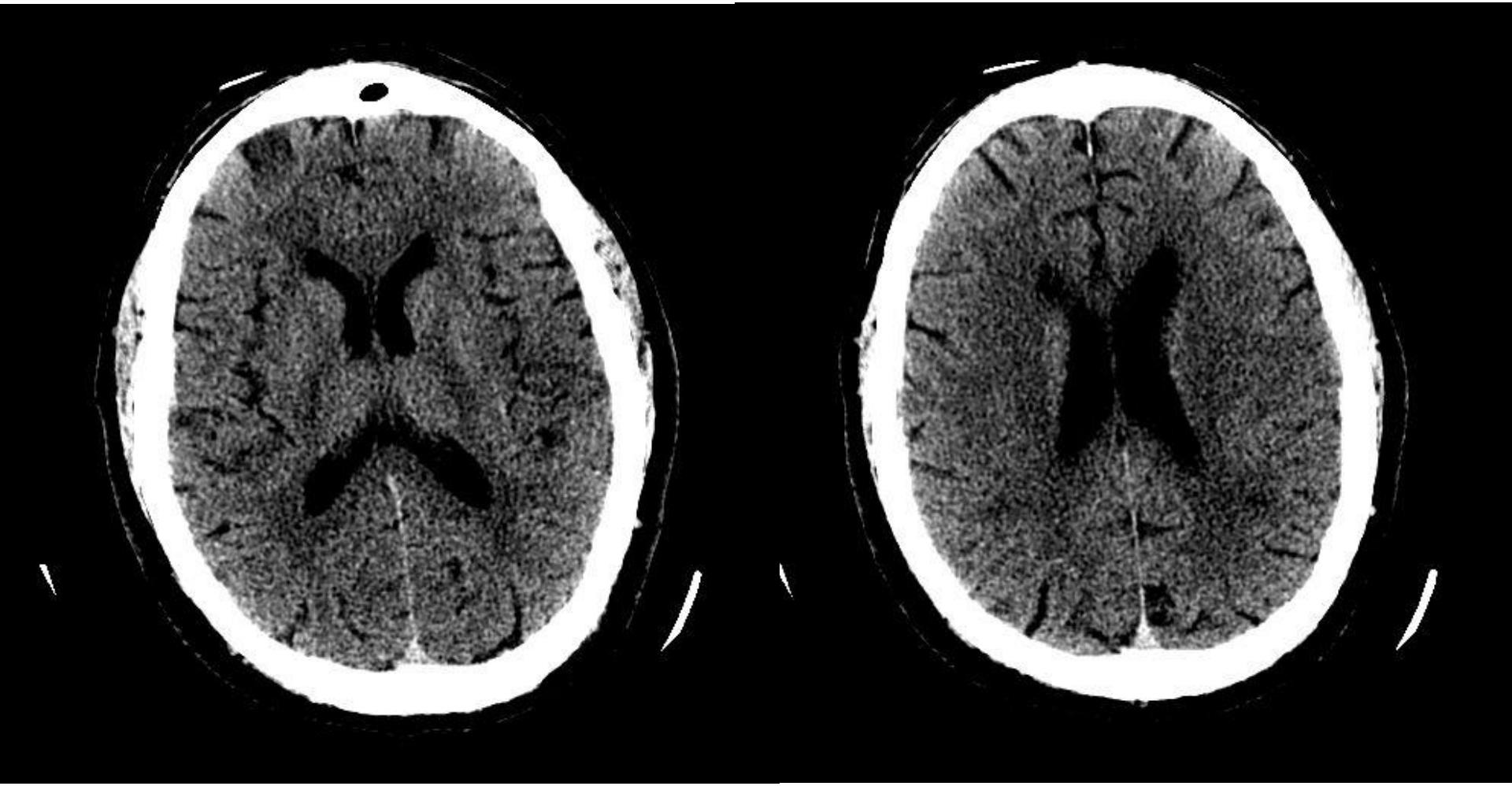
Alberta Stroke Program Early CT Score



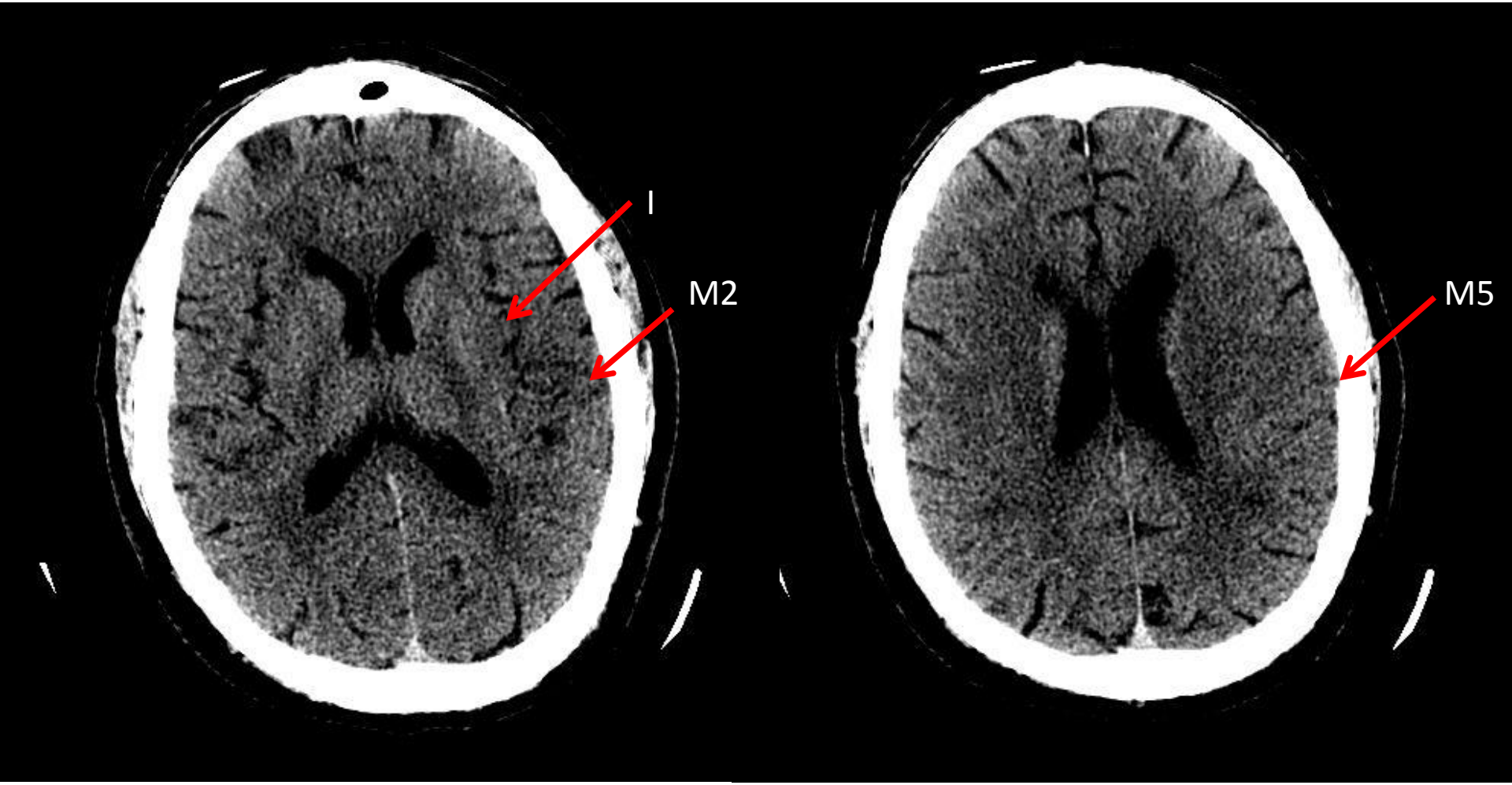
C = caudate, L = lentiform, I = insula, IC = internal capsule

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

Right hemiparesis and aphasia: Where is the infarct?

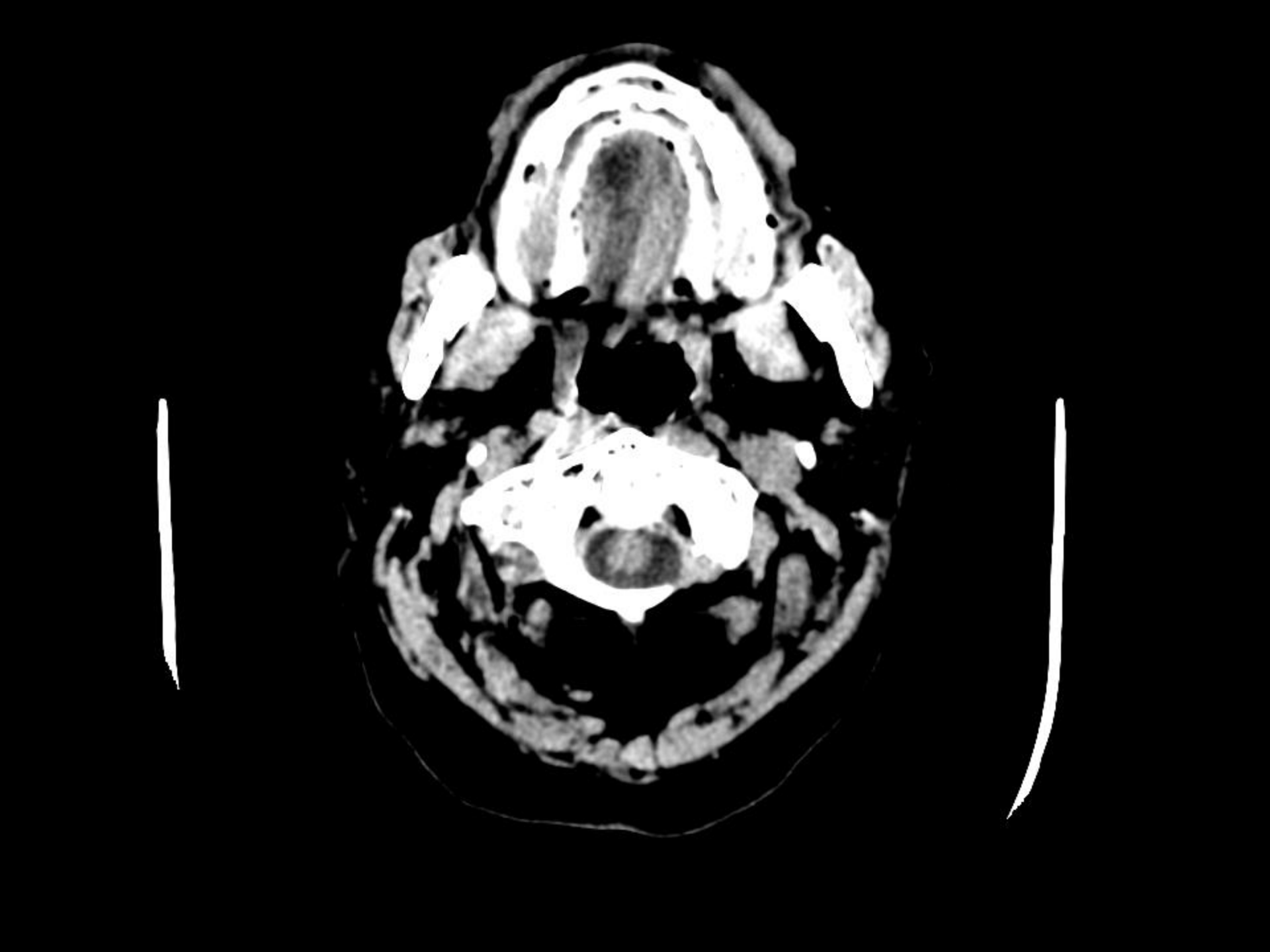


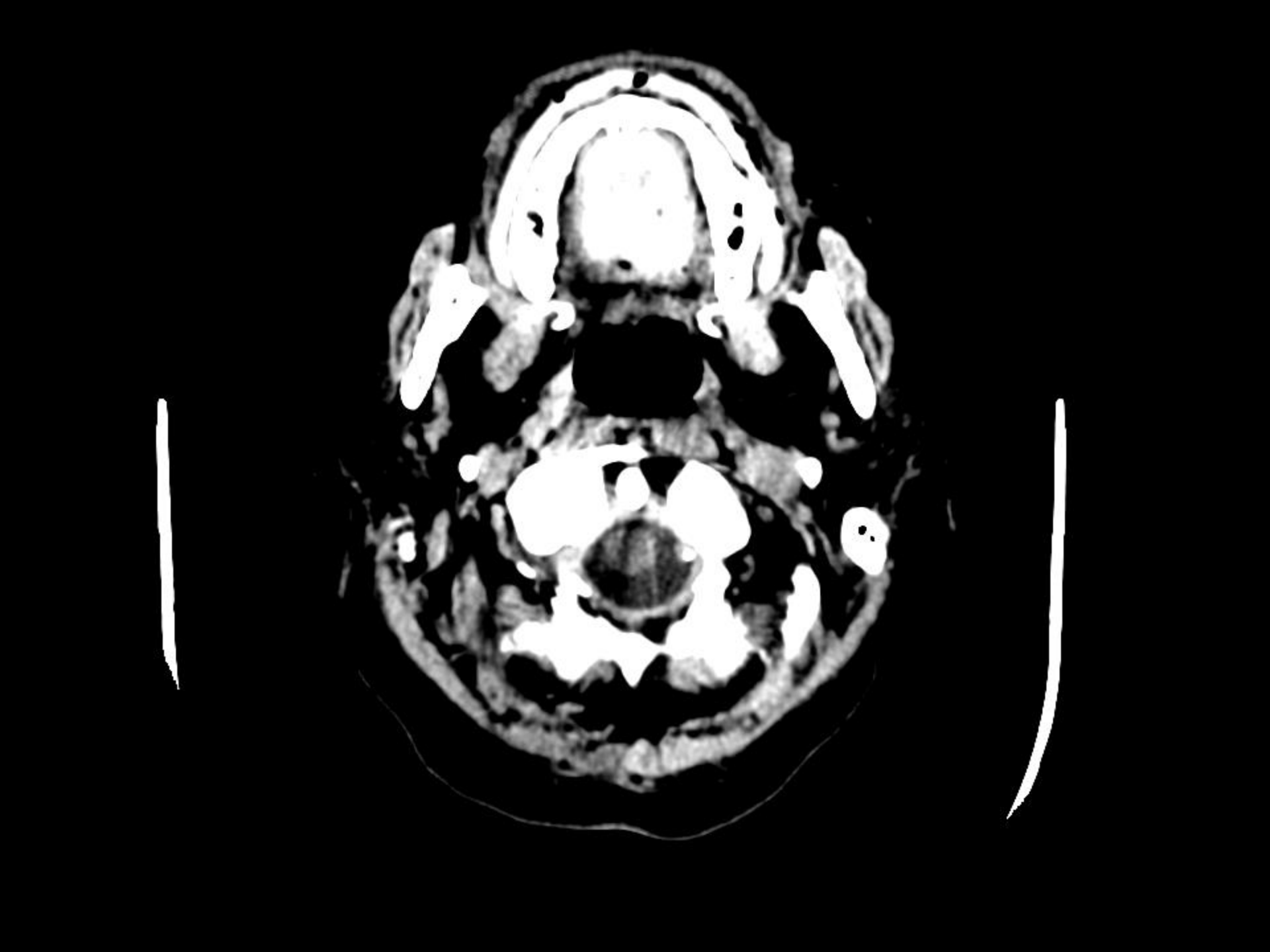
Can you see the infarct using ASPECTS?

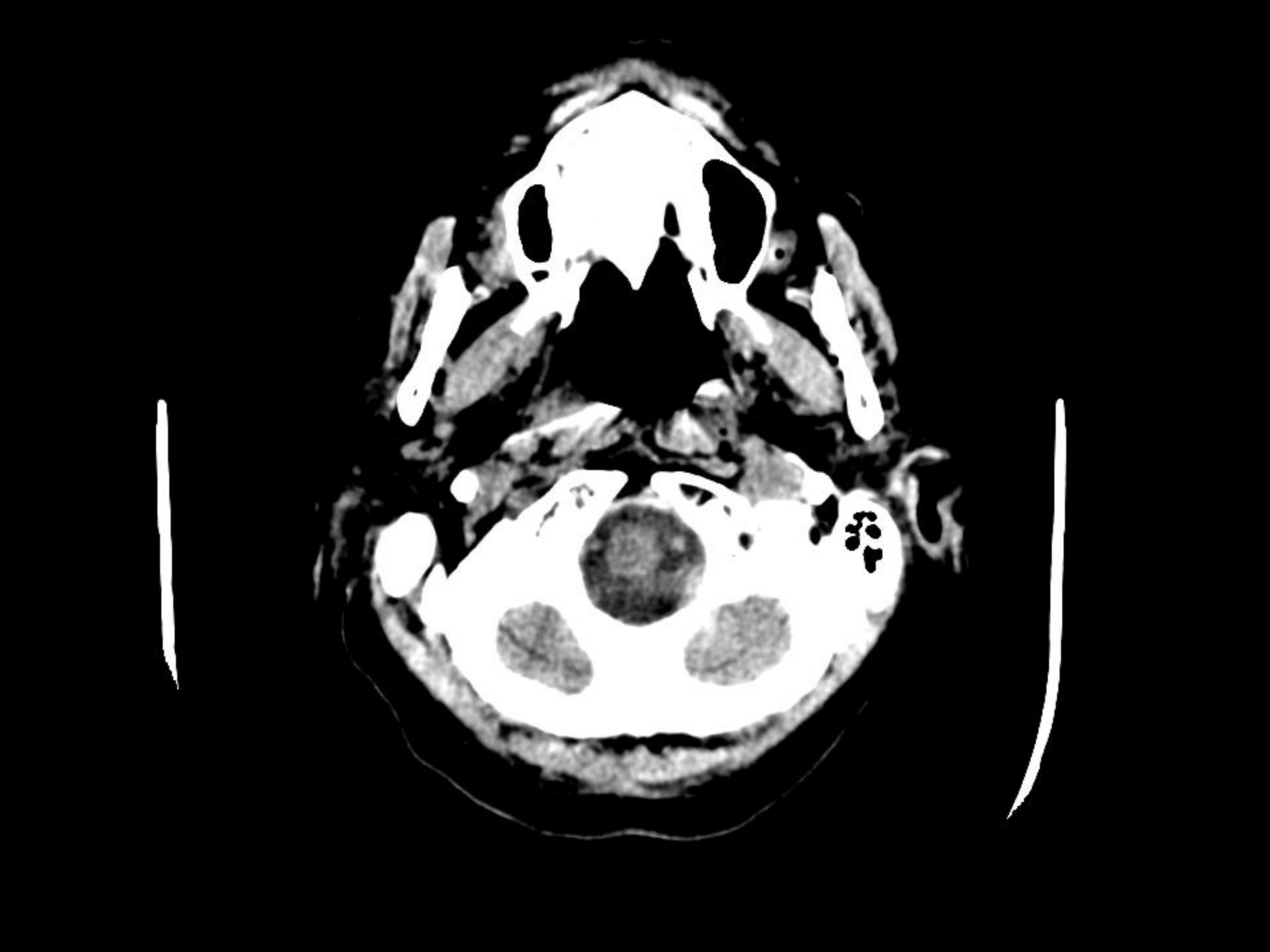


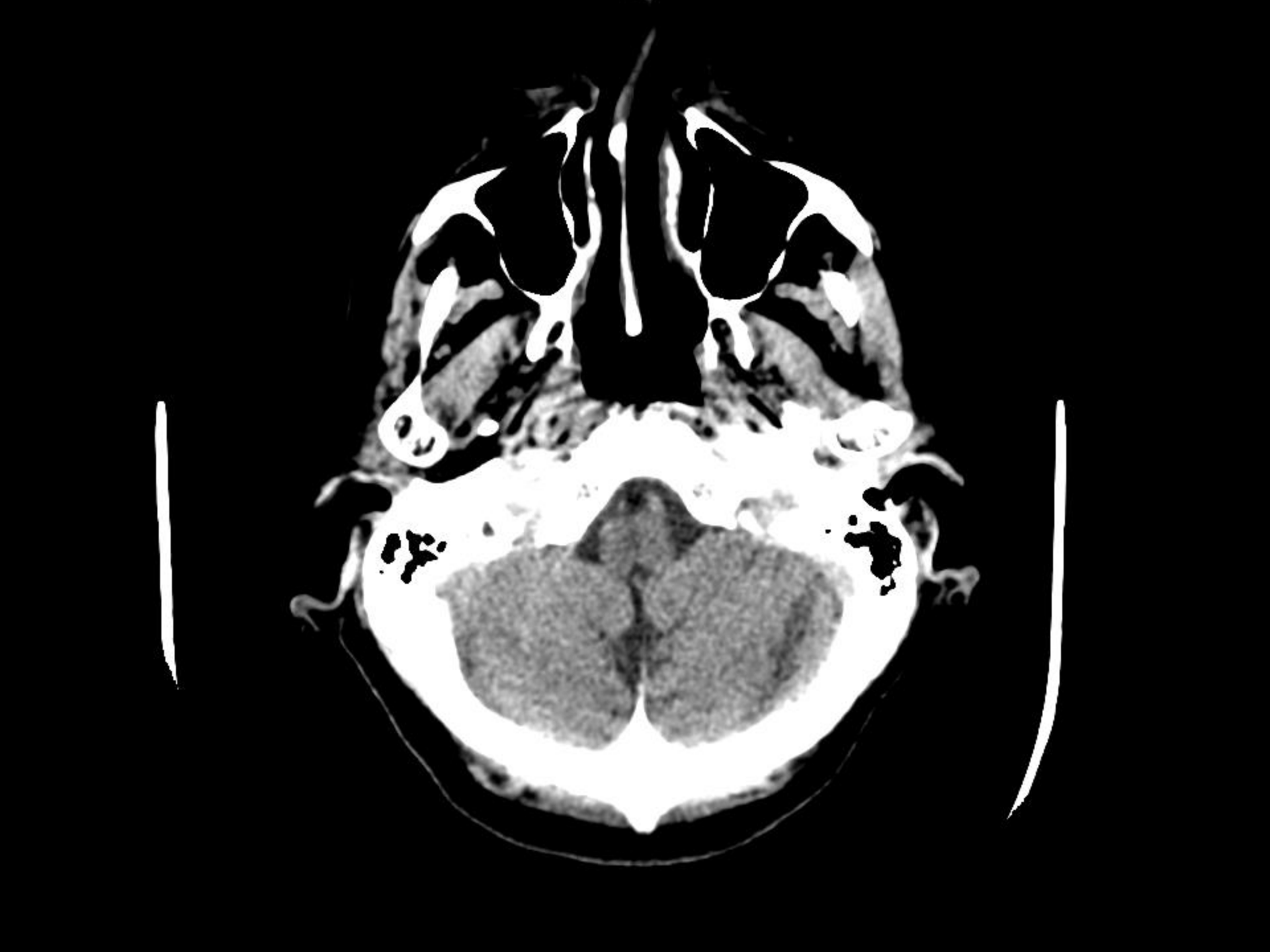
Case

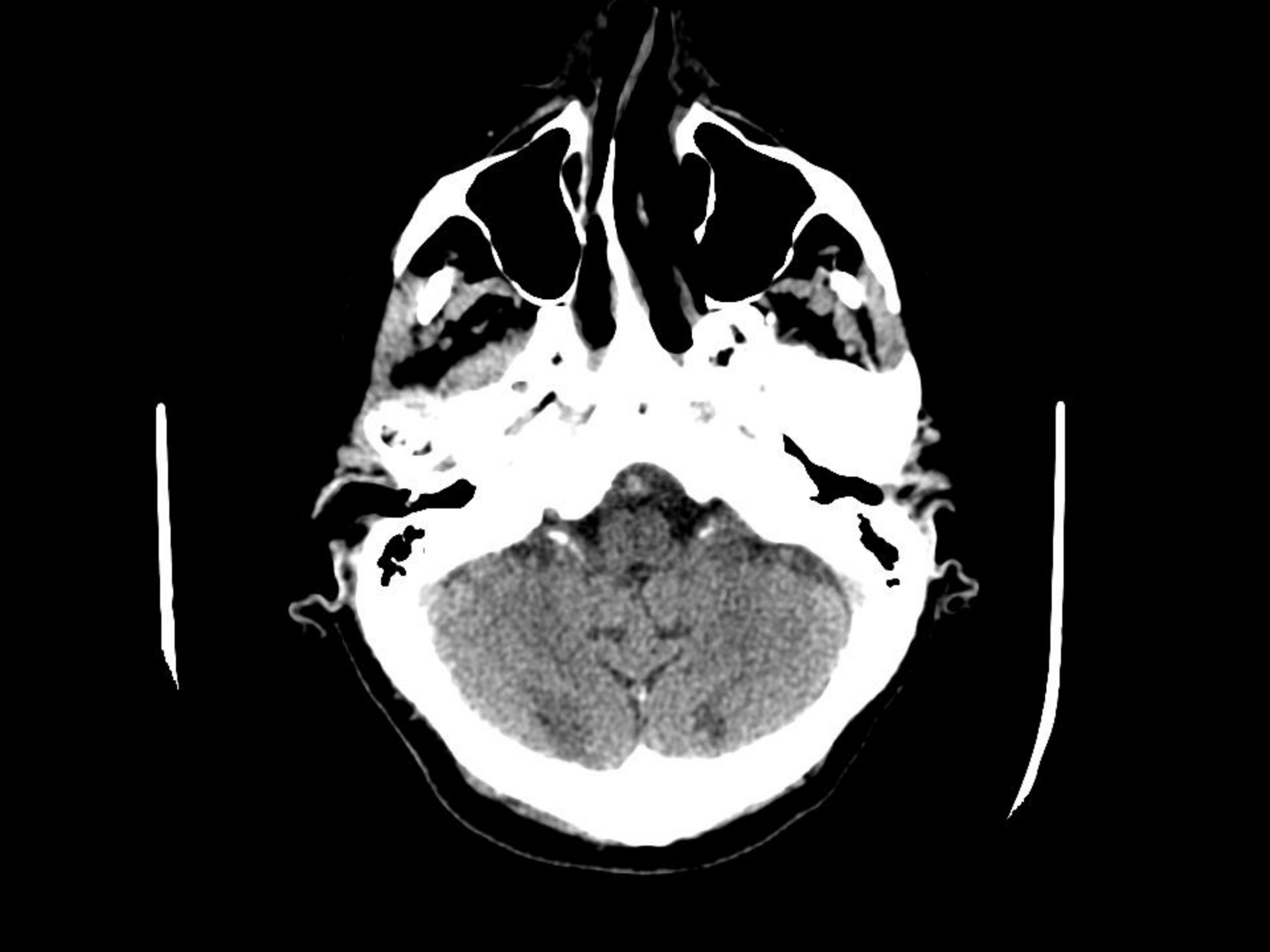
- 77 year old female with left hemiparesis, left homonymous hemianopia, left side sensory loss

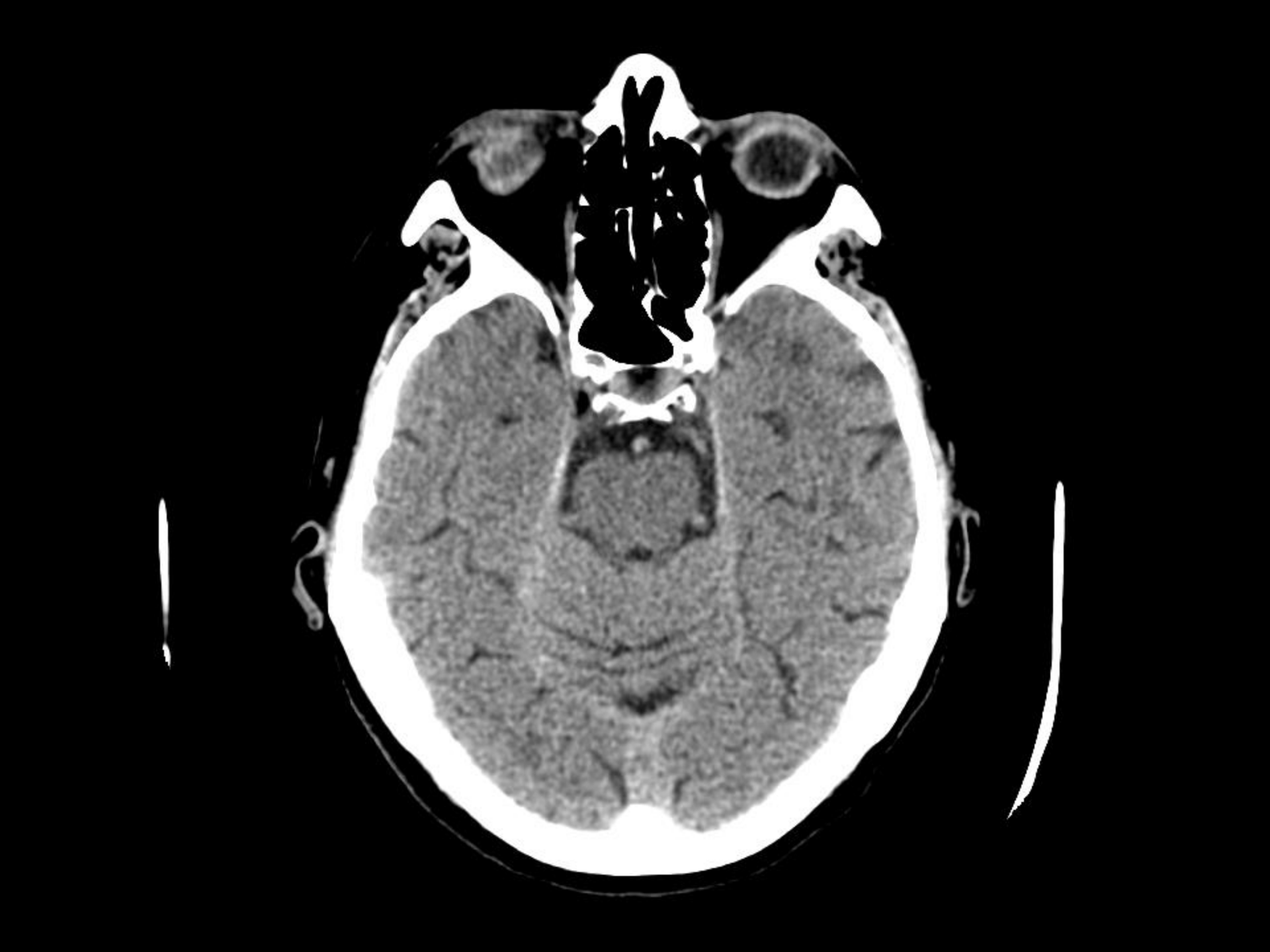


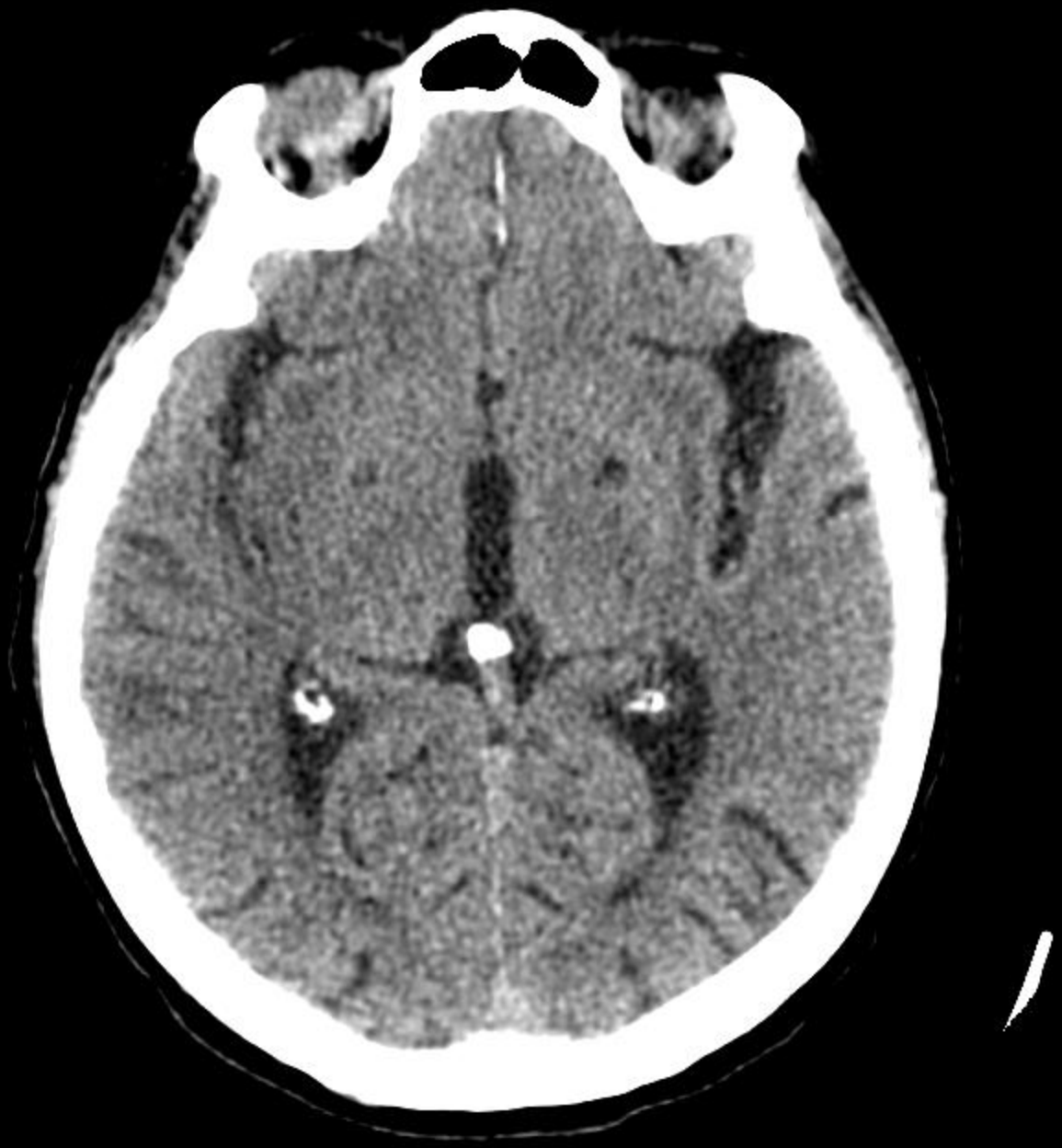


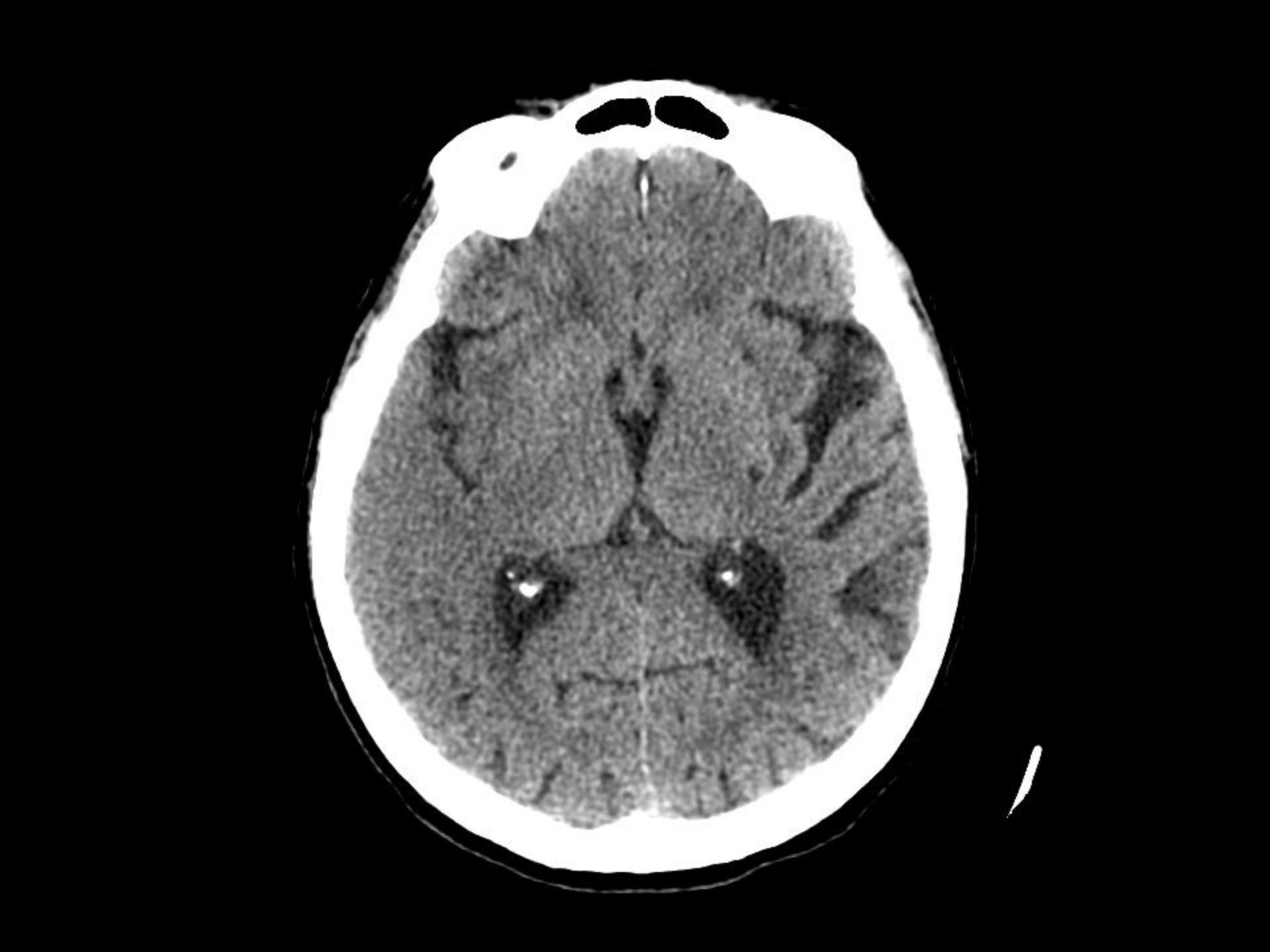


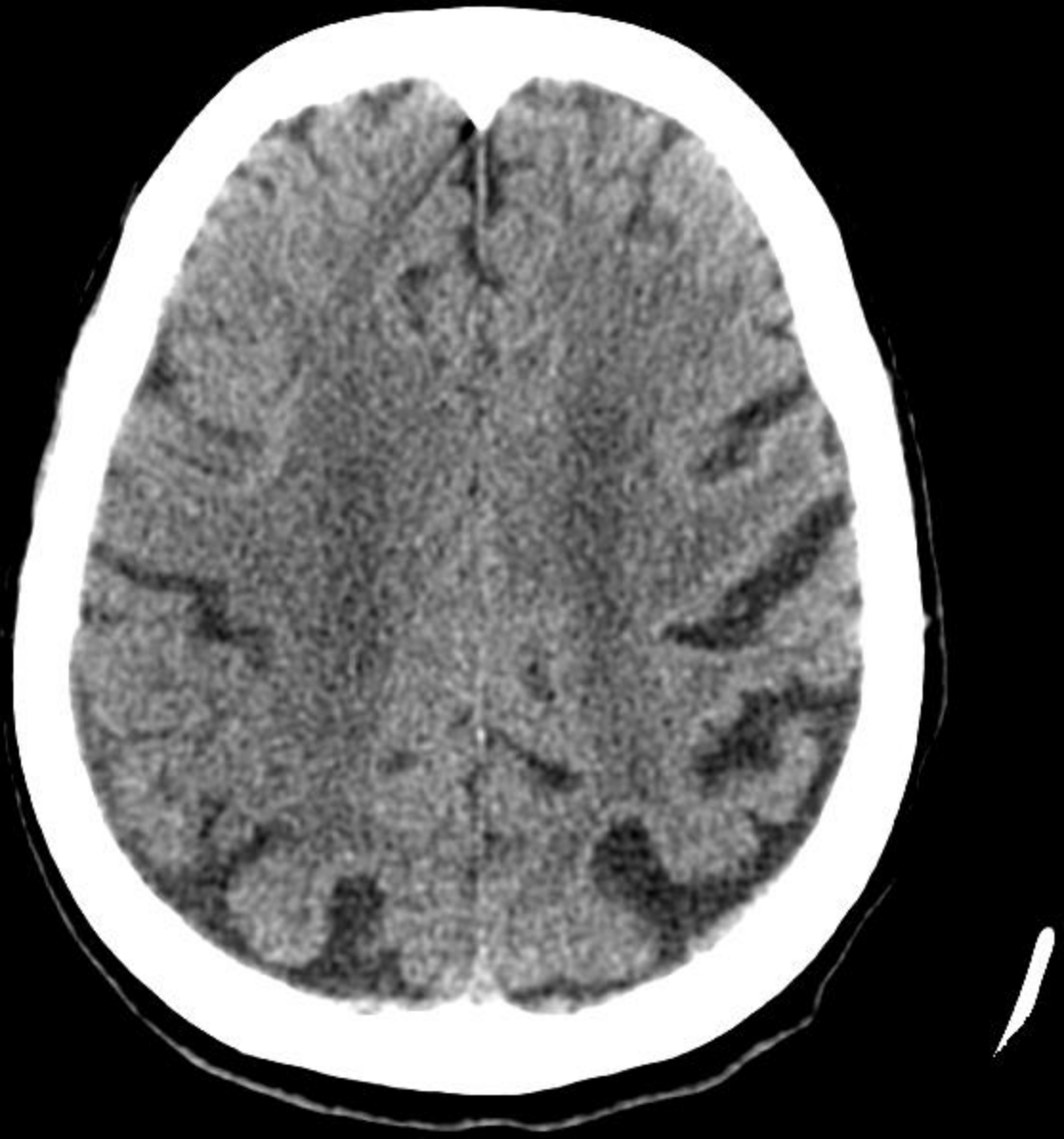


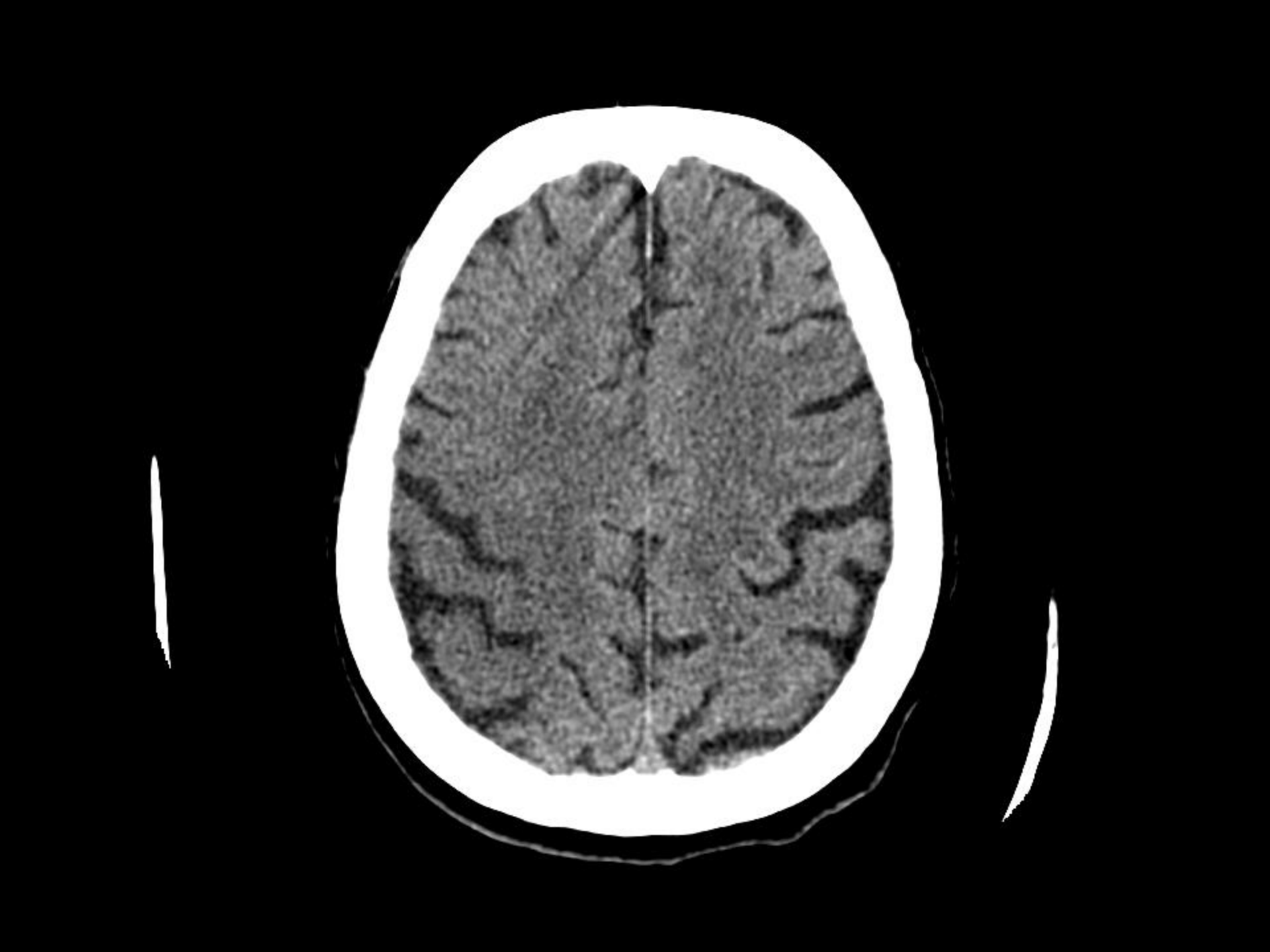


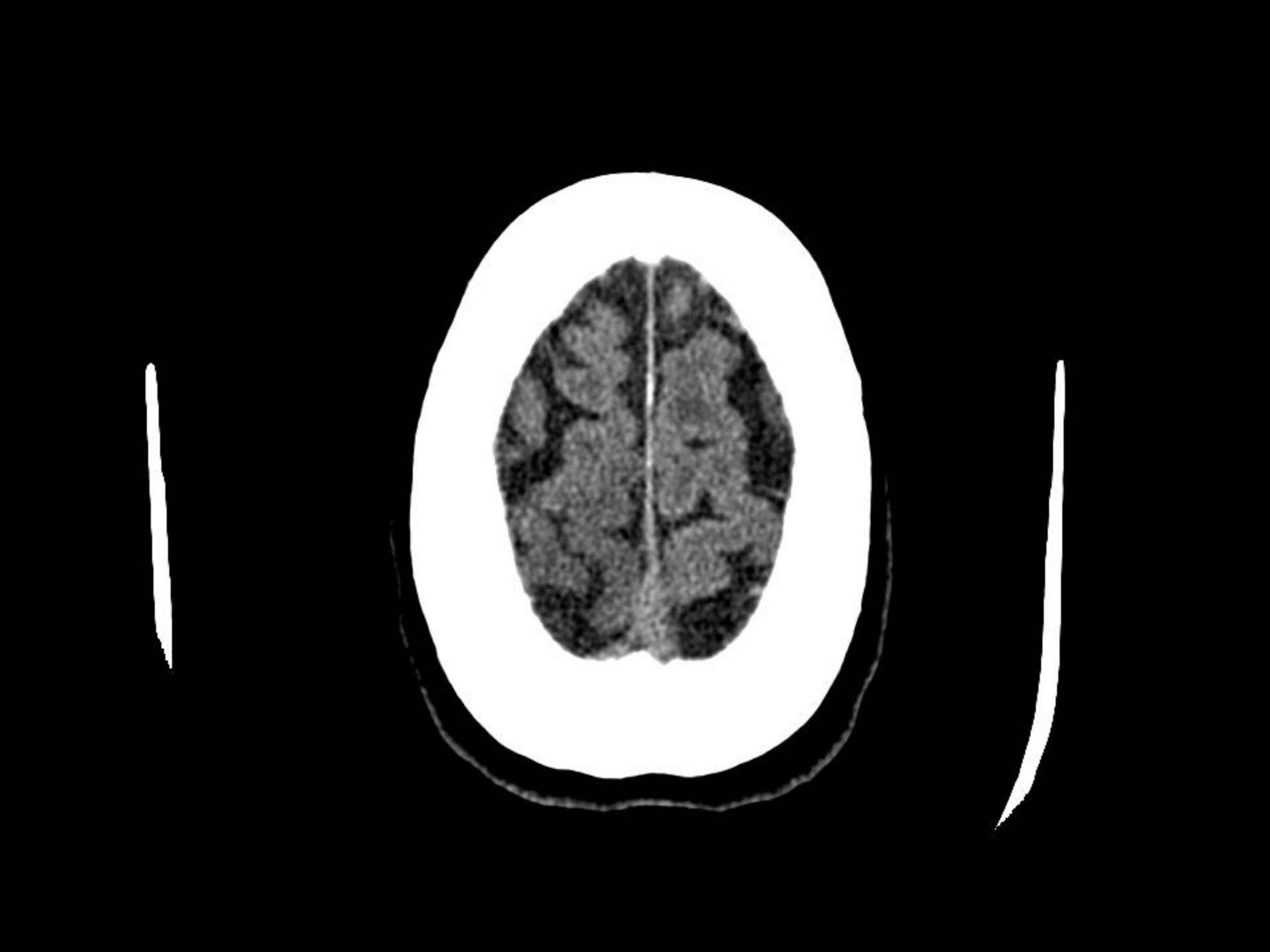


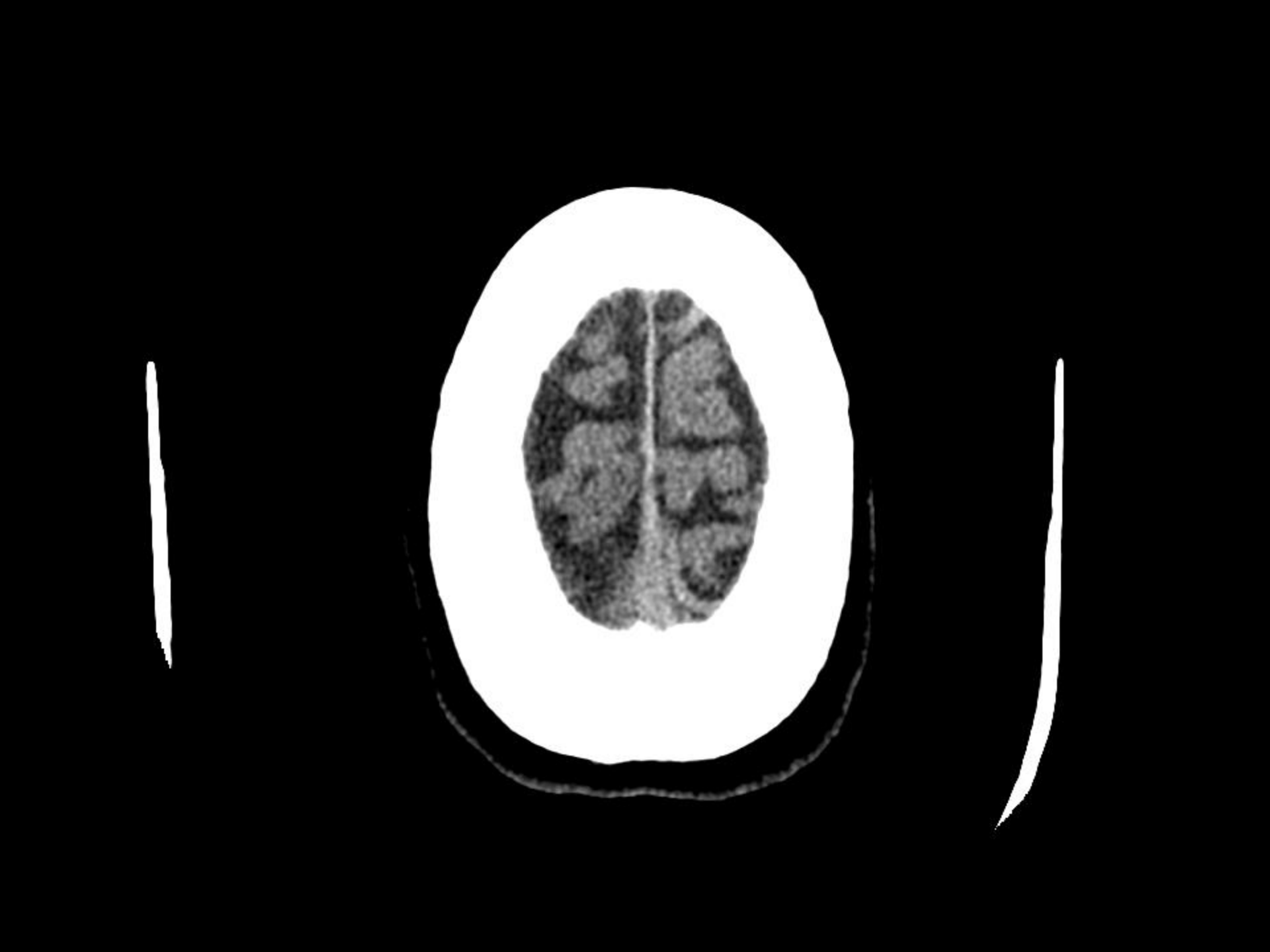


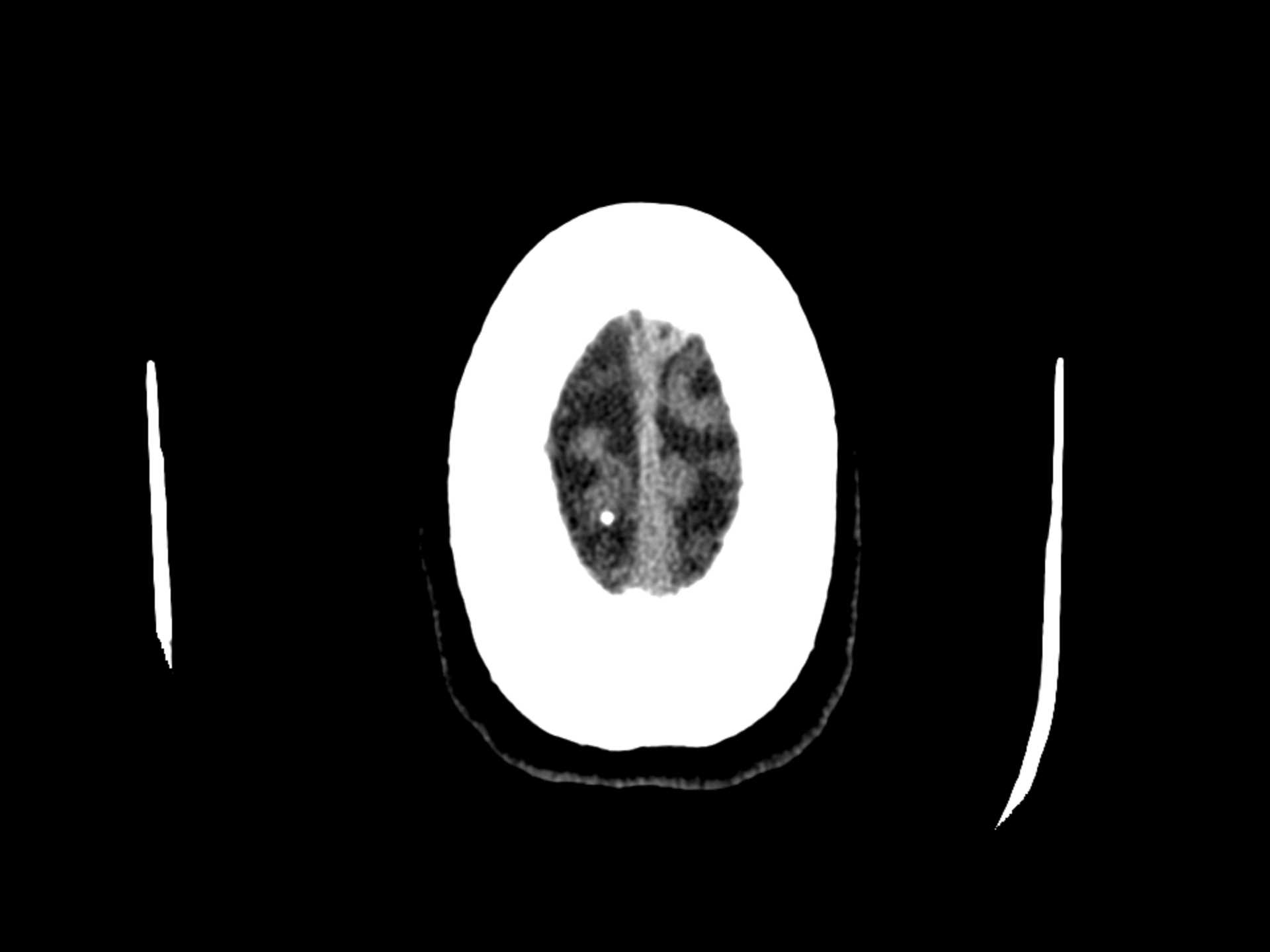












What to expect with ischemic stroke

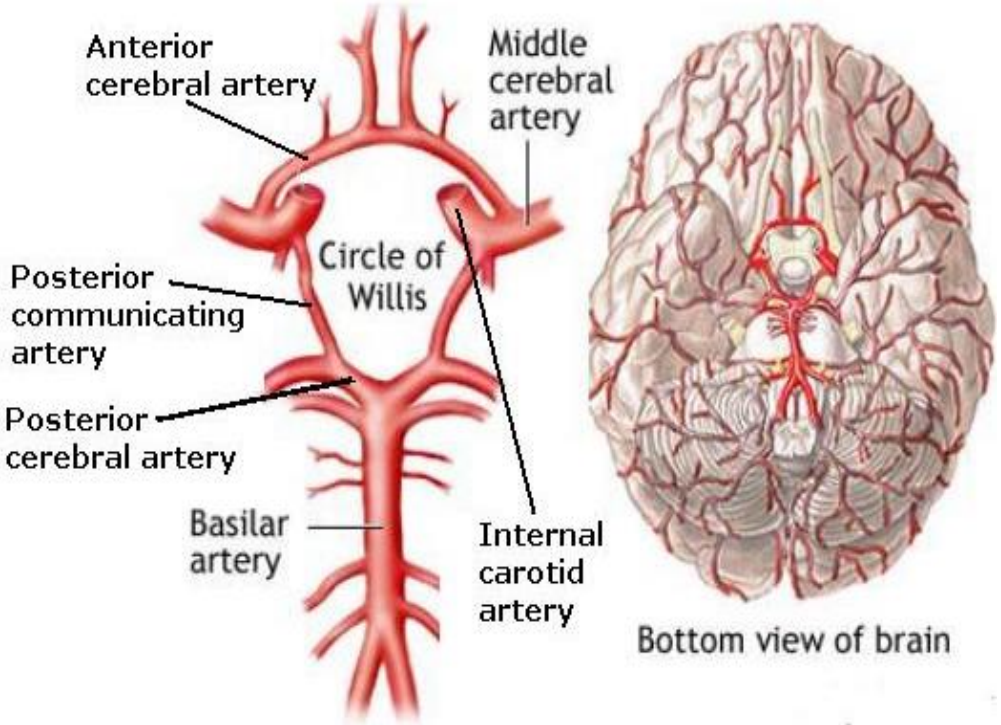
- If you can recognize the stroke syndrome, then you can anticipate the deficits you will find on neurological exam and you can predict the course

Localization and Vascular Territory is Key to Understanding Stroke Deficits

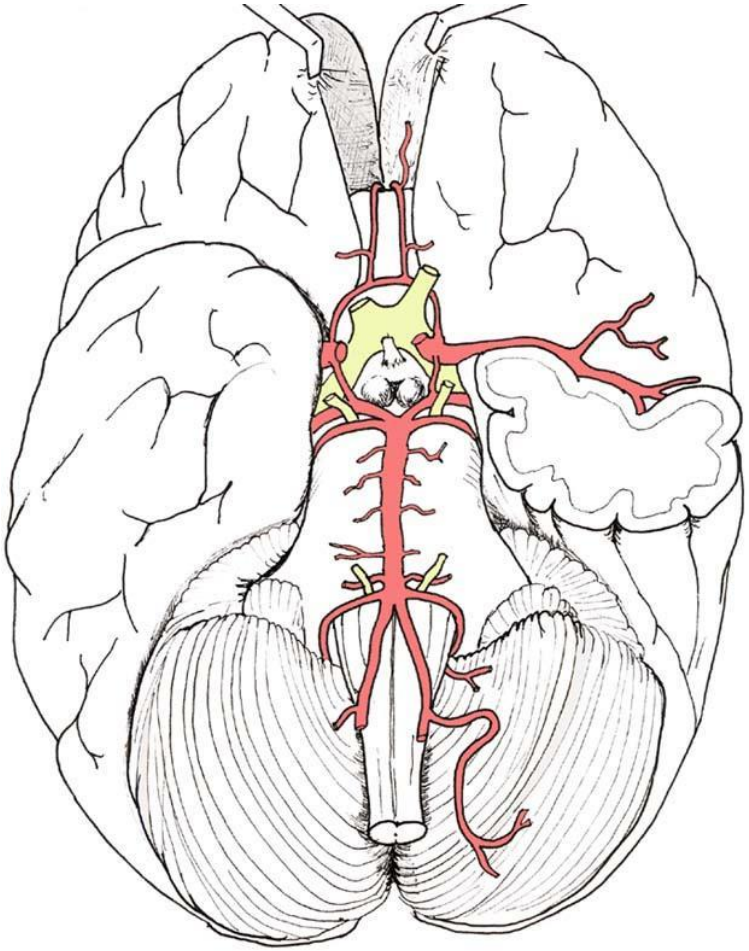
- Anterior circulation stroke:
  - Middle cerebral artery
  - Anterior cerebral artery
- Posterior circulation stroke:
  - Posterior cerebral artery (occipital lobe, thalamus, medial temporal lobe)
  - Brainstem (midbrain, pons, medulla)
  - Cerebellum
- Five common lacunar stroke syndromes
  - Pure motor stroke
  - Pure sensory stroke
  - Sensorimotor stroke
  - Ataxic hemiparesis
  - Clumsy hand-dysarthria

Anterior Circulation Stroke

- MCA and/or ACA
- Occlusion of the ICA can result in ischemia in both MCA and ACA territory simultaneously



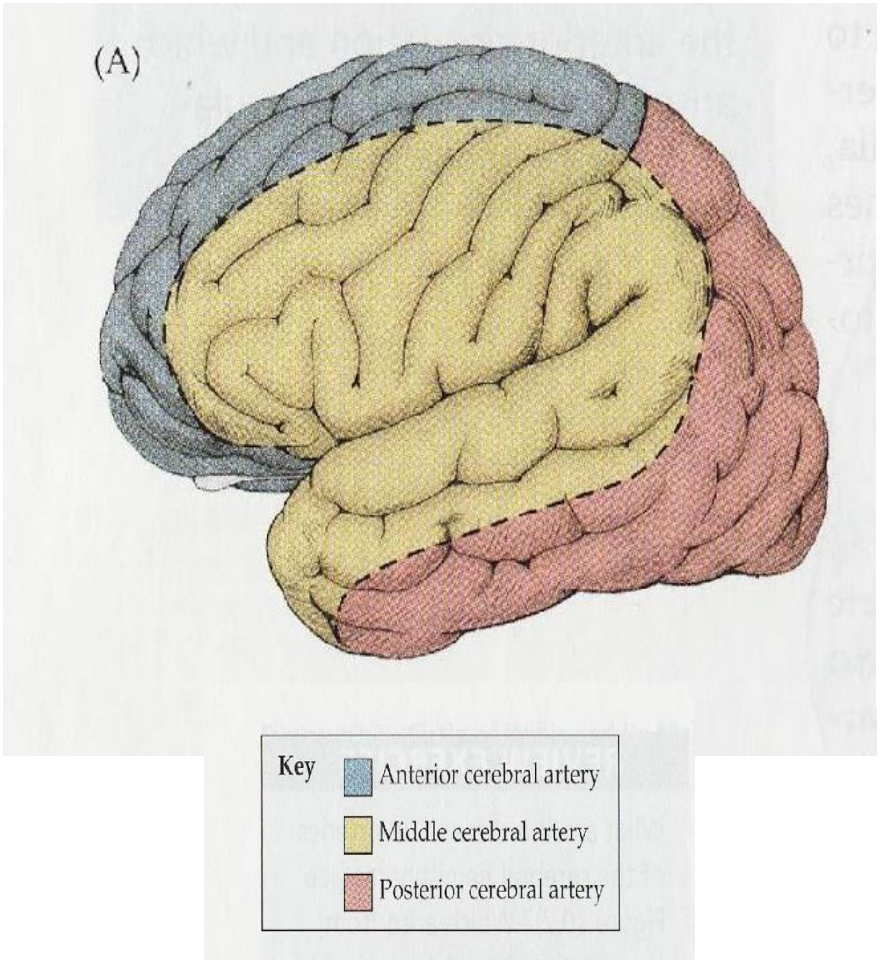
Middle cerebral artery

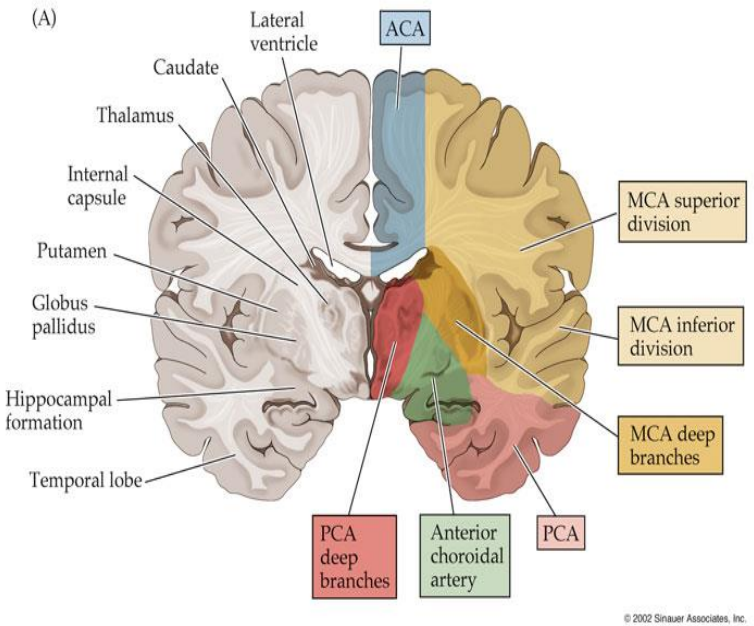


- About two-thirds of all ischemic stroke occurs in the middle cerebral artery territory
- MCA stroke can involve the frontal, temporal, and parietal lobes
- MCA stroke can also involve the basal ganglia through the *lenticulostriate arteries*

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

MCA covers a large portion of the hemisphere



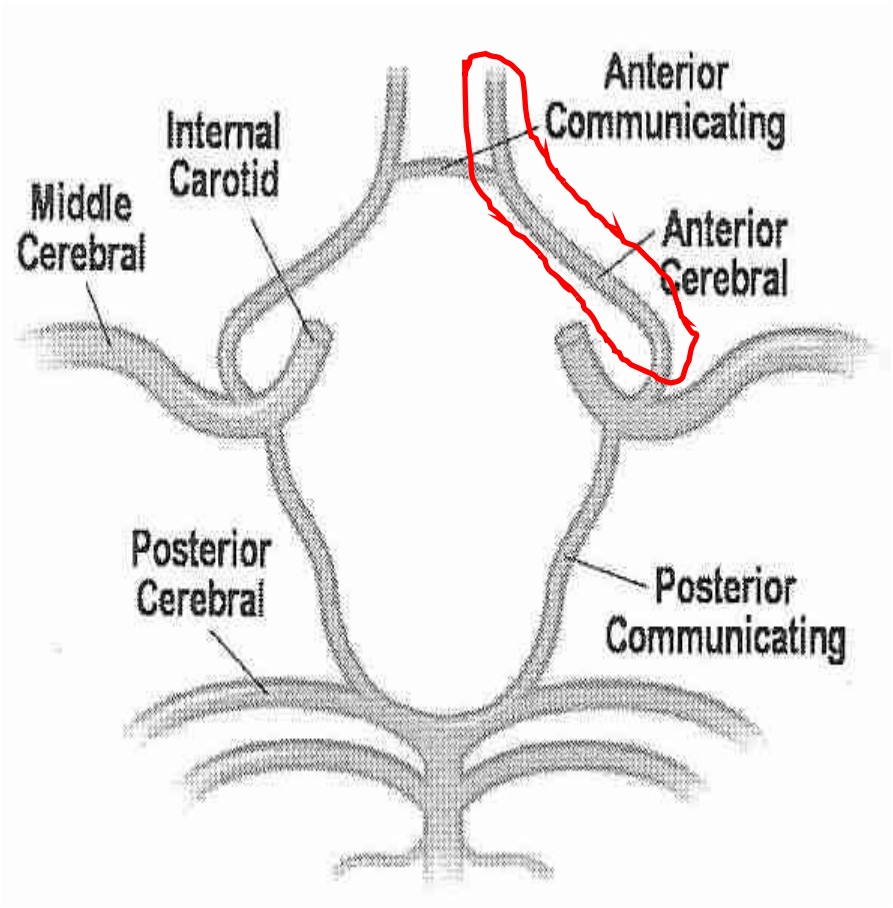


MCA stroke syndromes

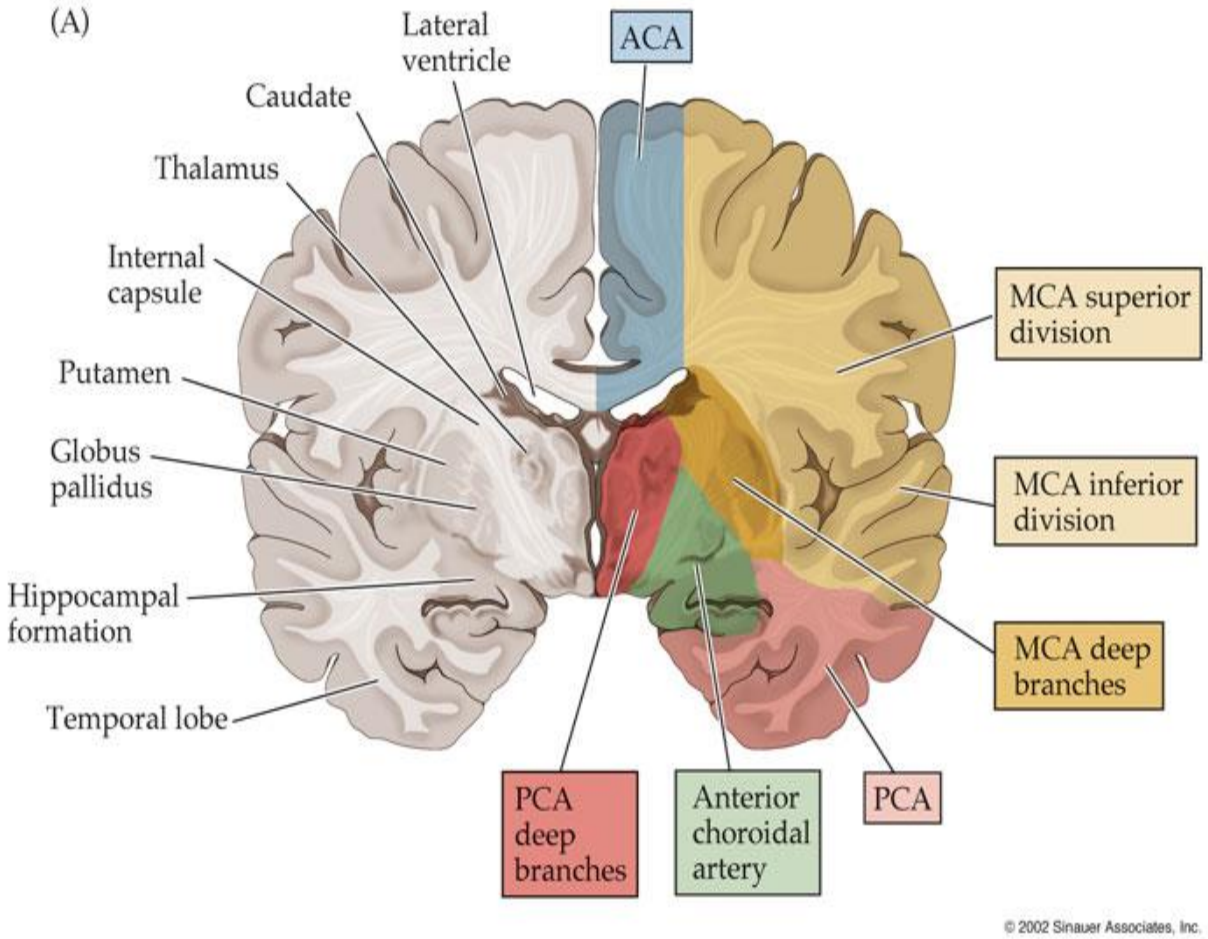
- **Left hemisphere (ie, dominant)**
- Right hemiparesis
- Right-sided sensory loss
- Right homonymous hemianopia
- Dysarthria
- **Aphasia**

- **Right hemisphere (ie, nondominant)**
- Left hemiparesis
- Left-sided sensory loss
- Left homonymous hemianopia
- Dysarthria
- **Neglect of the left side of environment**

Anterior cerebral artery



ACA covers the medial portion of the brain



ACA stroke syndrome

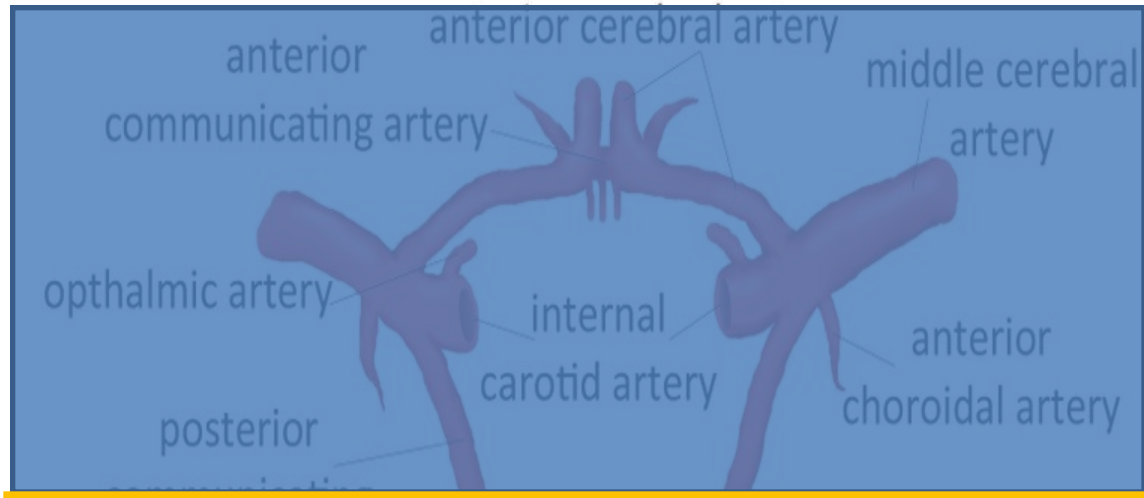
- How might this person present?
- What do you think you would find on the exam?

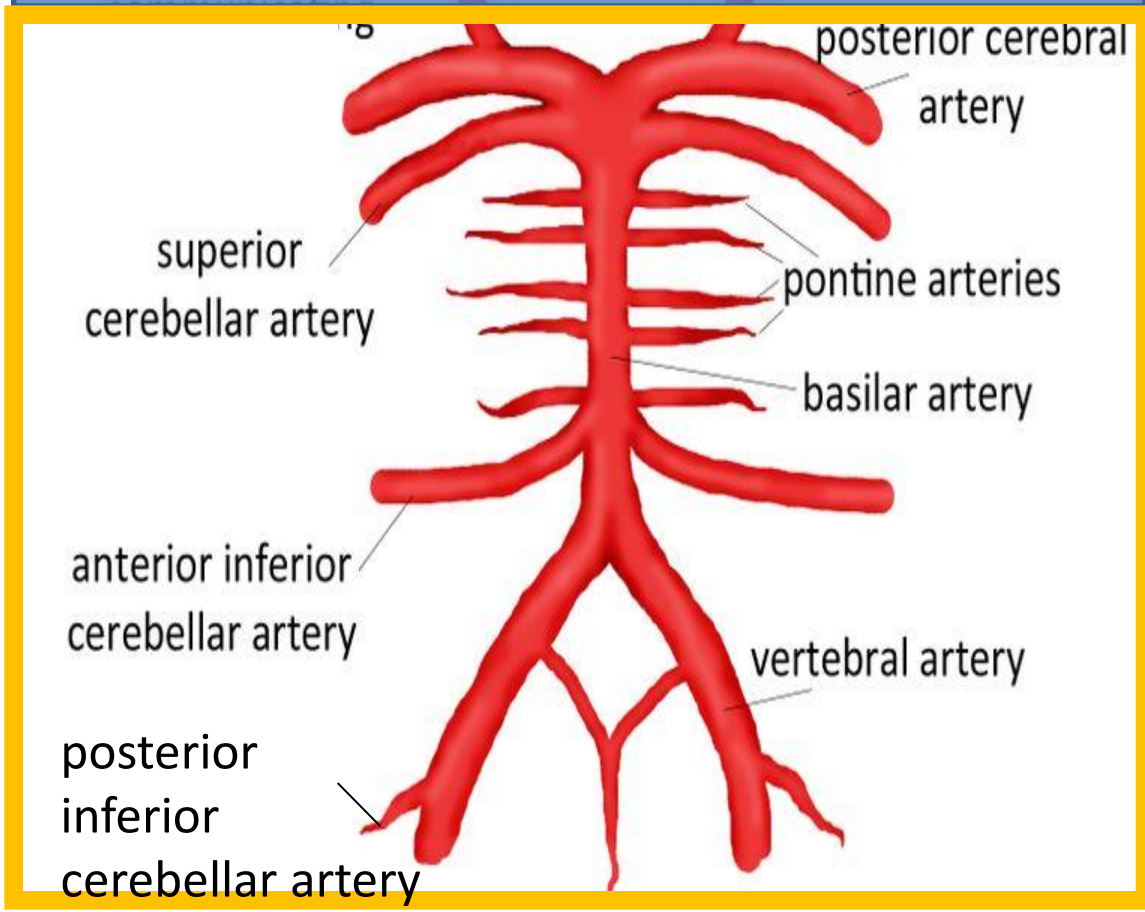
ACA stroke syndrome

- Contralateral leg paresis > arm paresis
- Or, bilateral leg weakness if both ACAs are involved
- Abulia, disinhibition, executive dysfunction
- In some cases, akinetic mutism if bilateral caudate head infarction

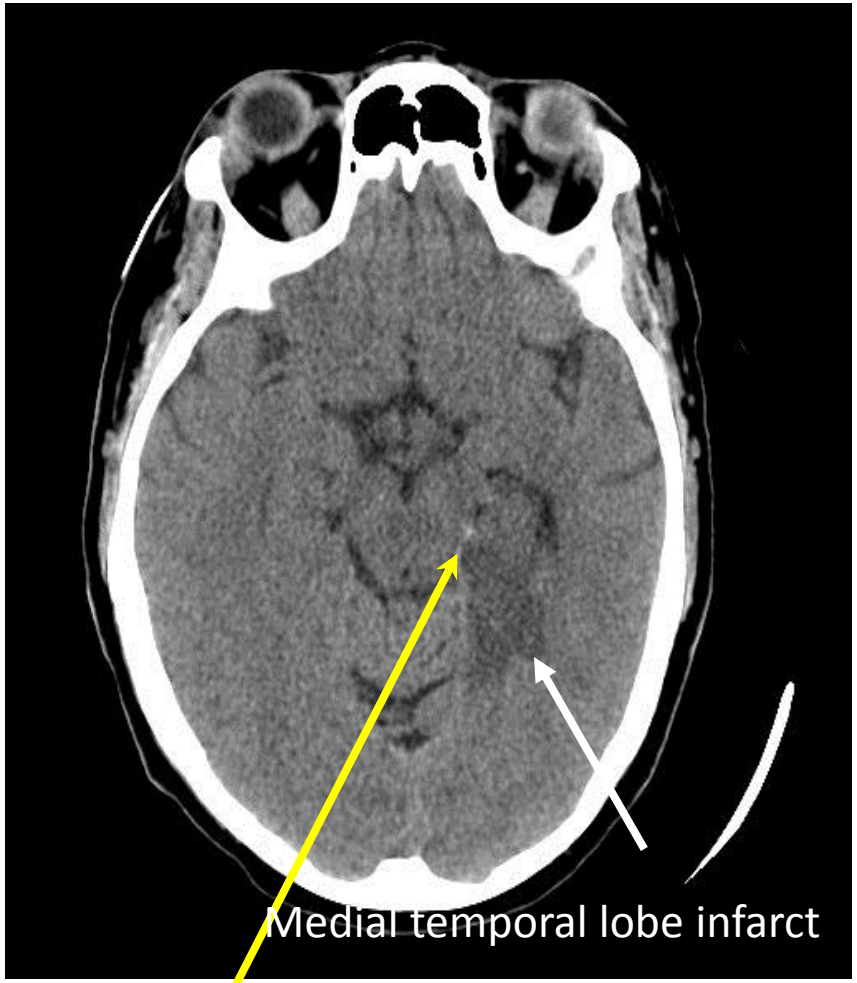
Posterior Circulation

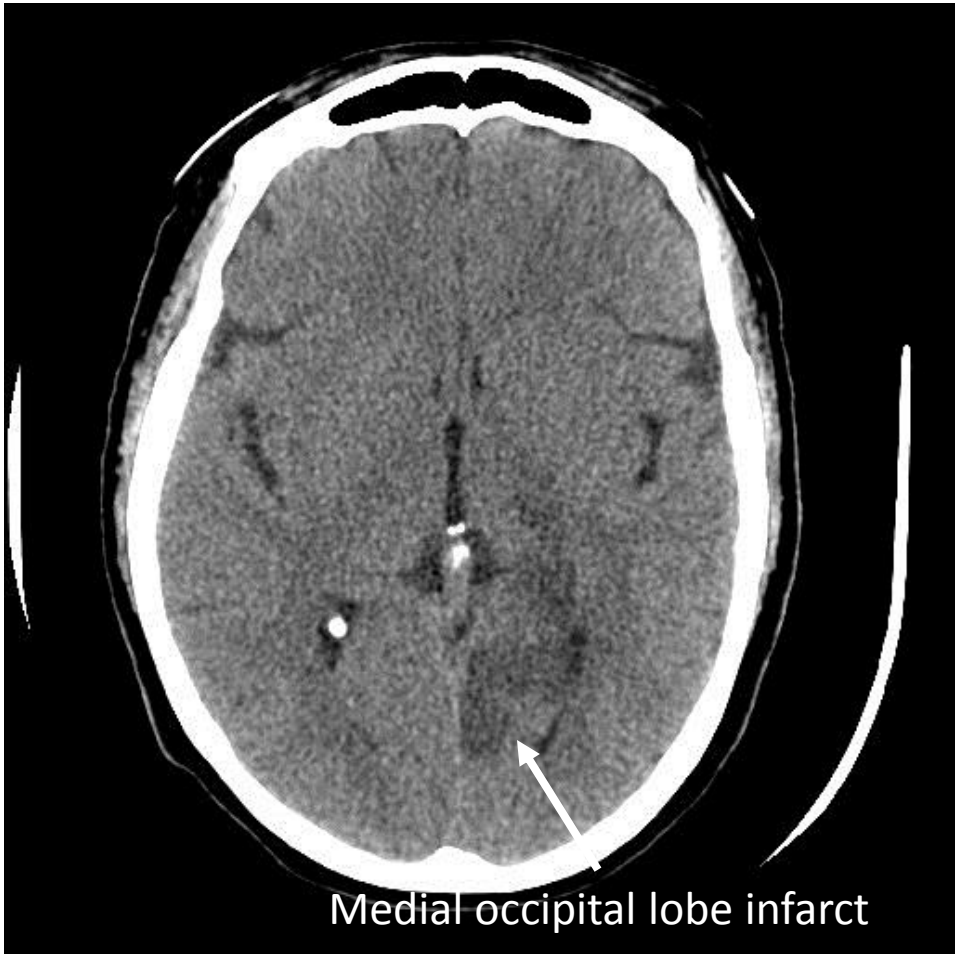
- This includes:
  - Vertebral arteries
  - Posterior and anterior inferior cerebellar artery
  - Basilar artery
  - Pontine arteries
  - Superior cerebellar artery
  - Posterior cerebral artery





Left PCA infarction on CT





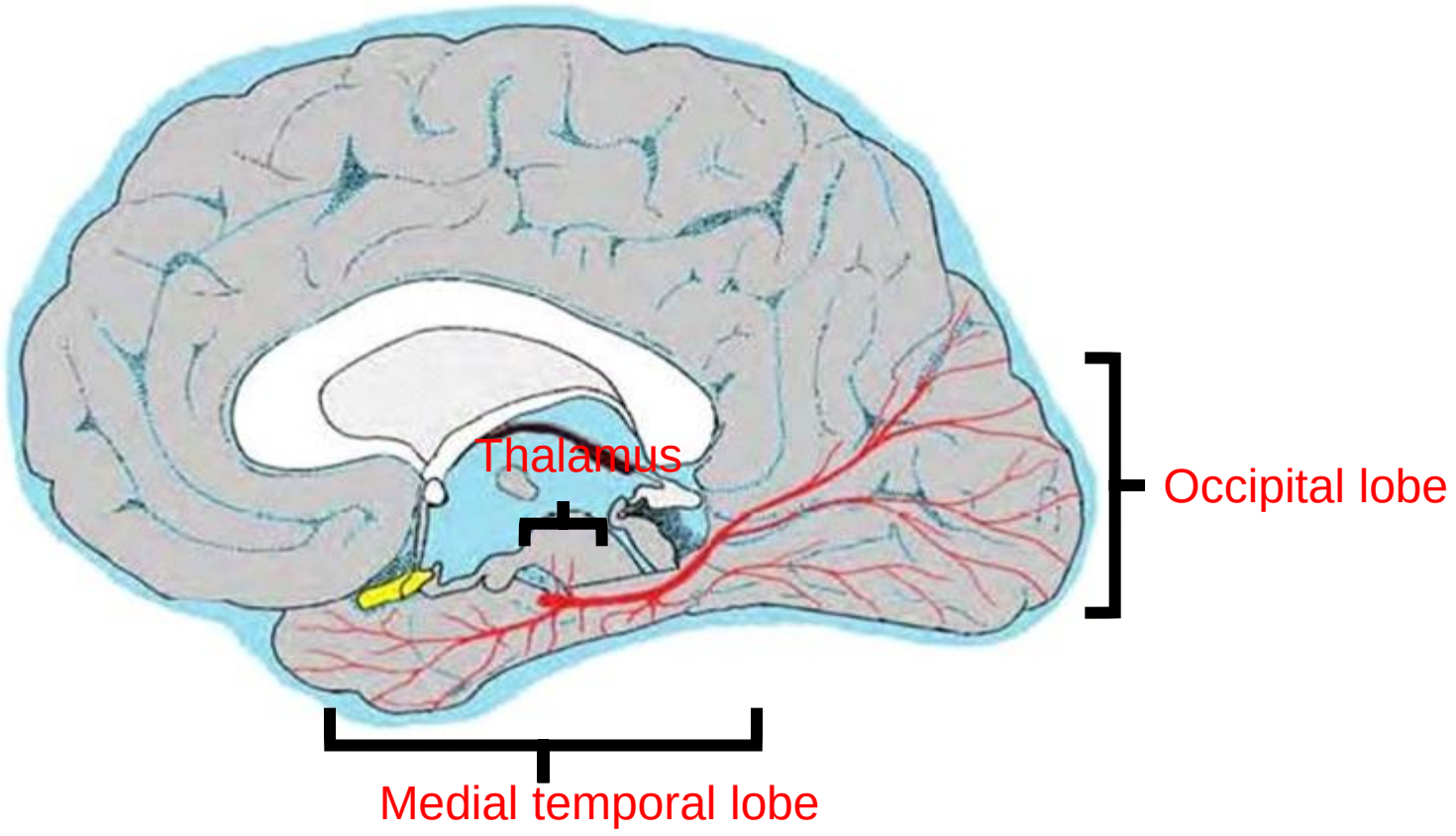
This is a thrombus in the left PCA

- How might this person present?
- What do you think you might find on exam?

PCA stroke syndromes

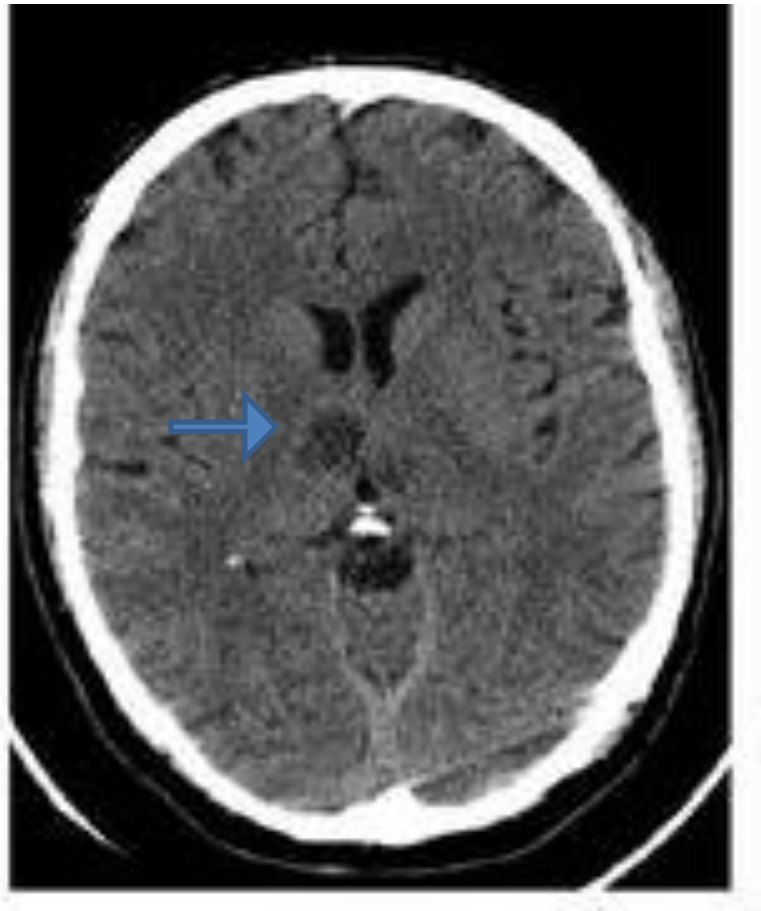
- The most common syndromes involve the occipital lobe, the medial temporal lobe or the thalamus
- Occipital lobe:
  - Contralateral homonymous hemianopia
  - Cortical blindness (bilateral lesions)
- Medial temporal lobe:
  - Deficits in long-term and short-term memory
  - Behaviour alteration (agitation, anger, paranoia)

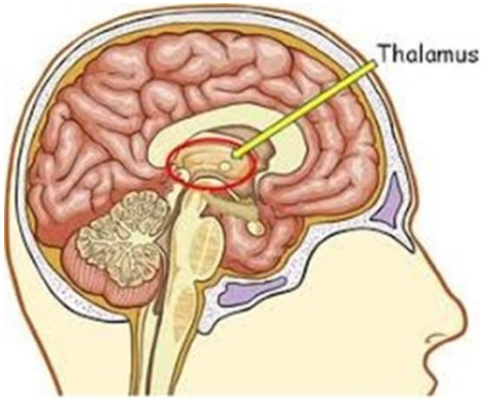
PCA perfuses three main areas of the brain



PCA stroke syndromes, cont'd

- Thalamic infarct
  - –Contralateral sensory loss
  - –Aphasia (if dominant side involvement)
  - –Executive dysfunction
  - –Decreased level of consciousness
  - –Memory impairment





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

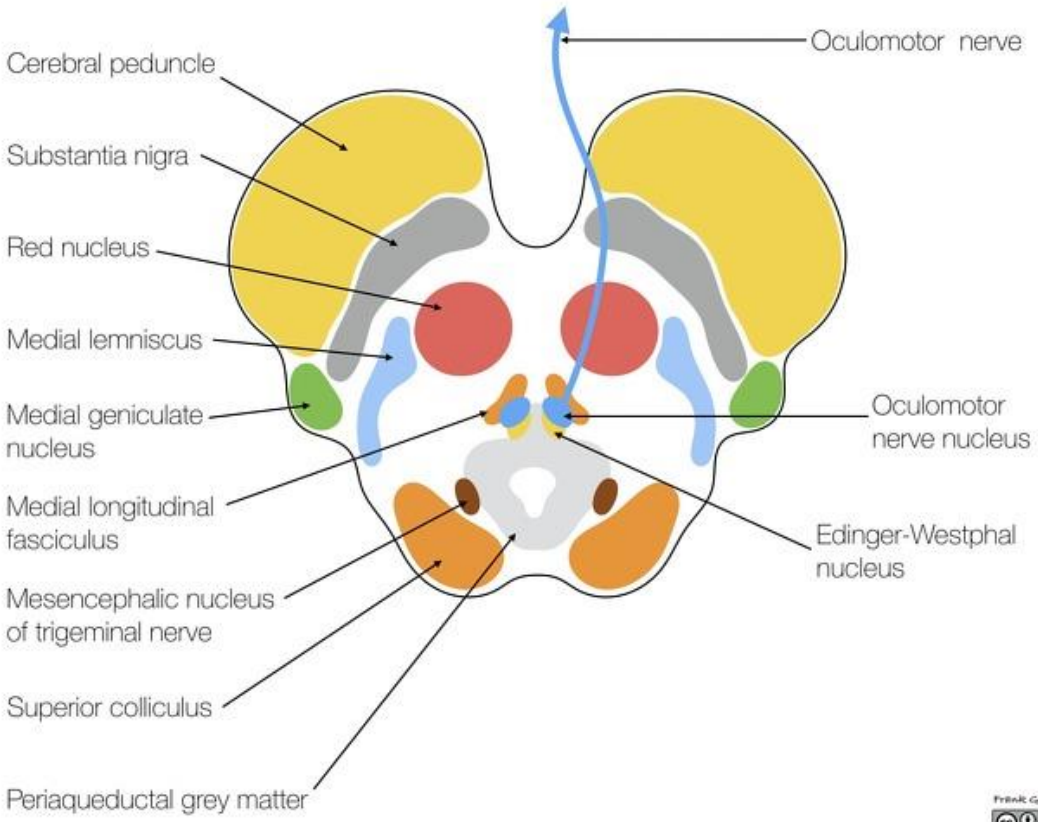
- Ataxia and vertigo, limb dysmetria
- Diplopia and eye movement abnormalities
- Dysarthria, dysphagia
- Tongue deviation
- Deafness (very rare)
- Locked-in syndrome (can’t move any limb, can’t speak, can sometimes blink

Midbrain stroke

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

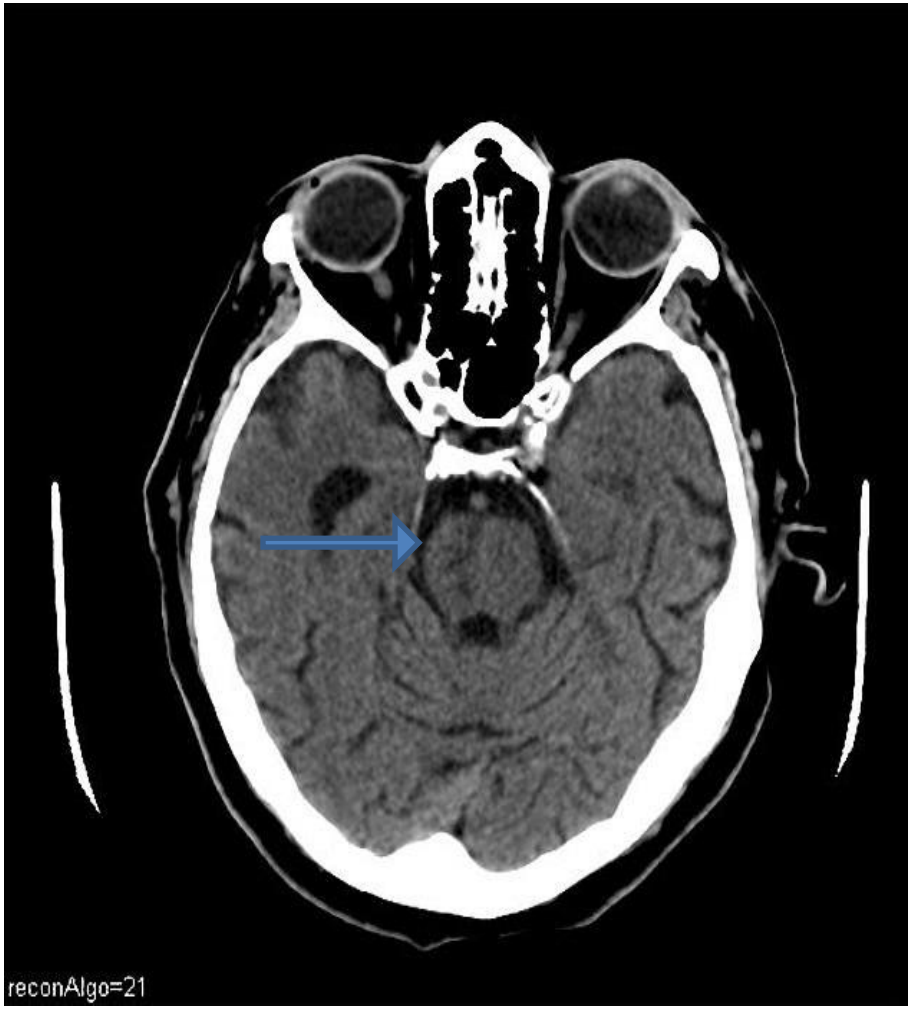
Midbrain

Axial section at the level of the superior colliculus and CN III

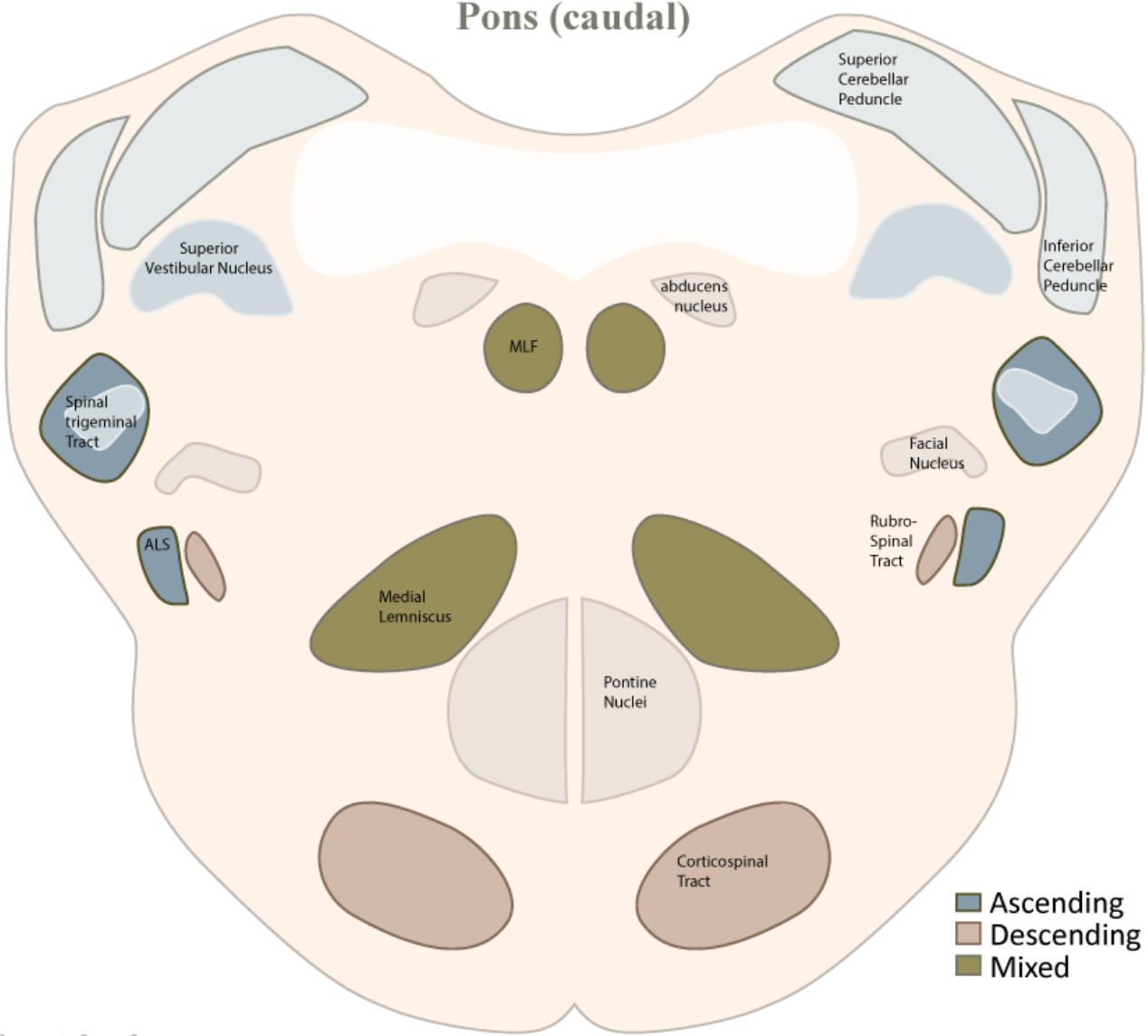


Pontine stroke

- 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



Pons (caudal)



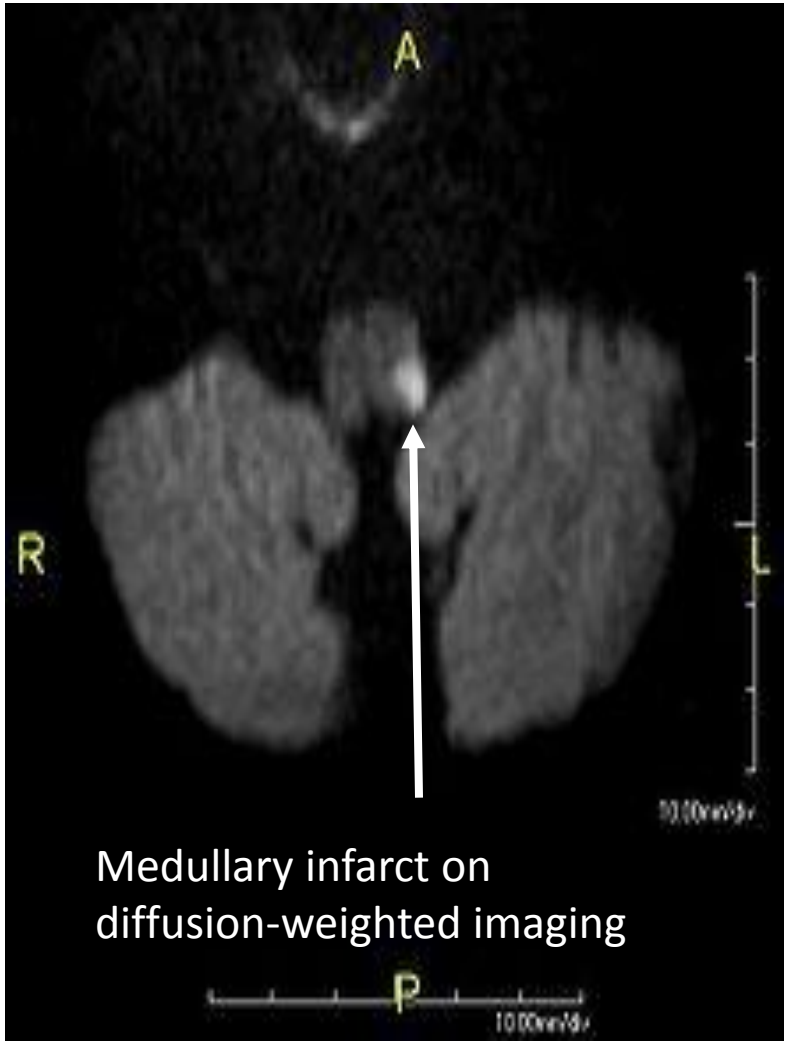
from Haines (1987) Neuroanatomy, p. 95

Horner’s syndrome

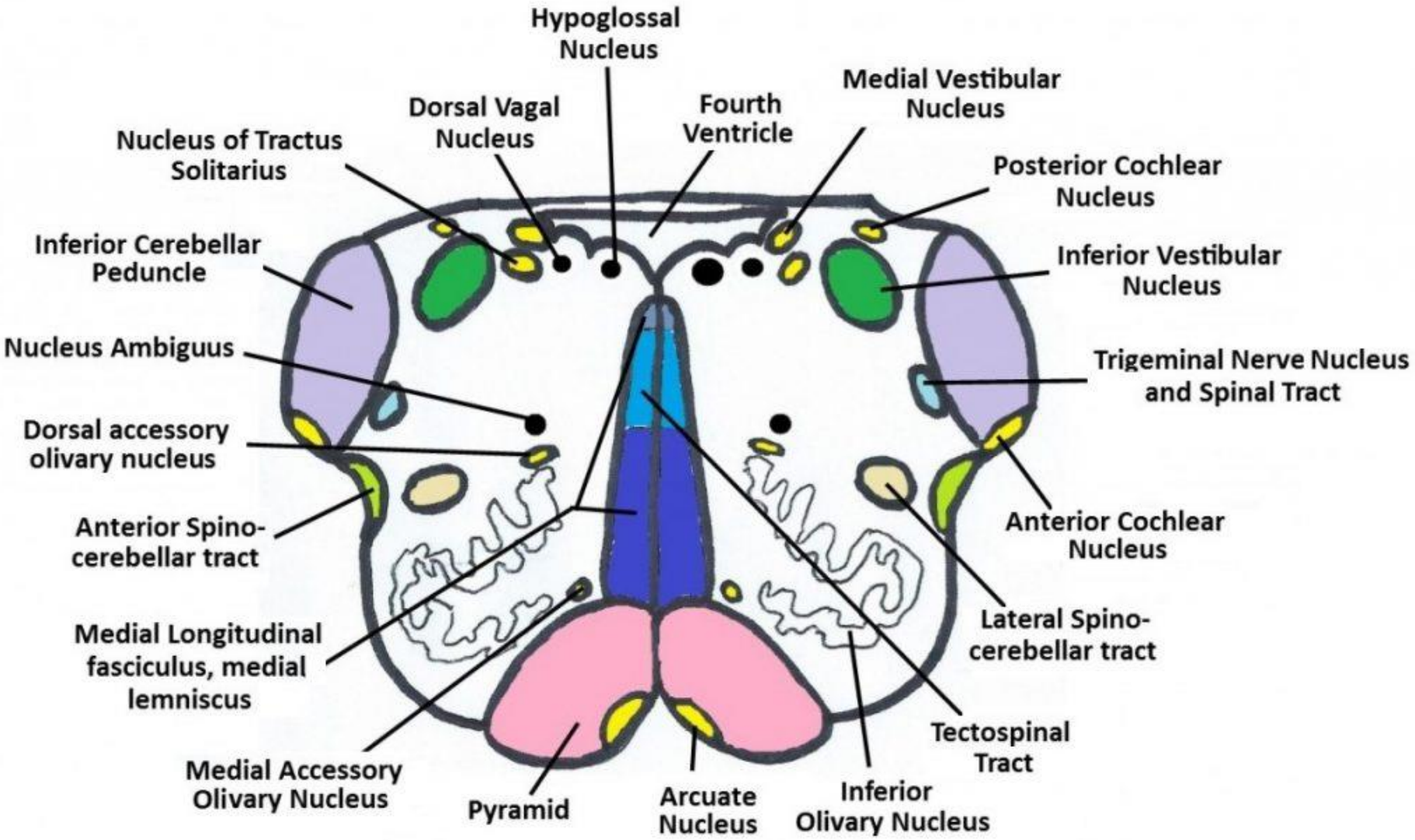
- Ptosis
- Miosis
- Anhydrosis

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

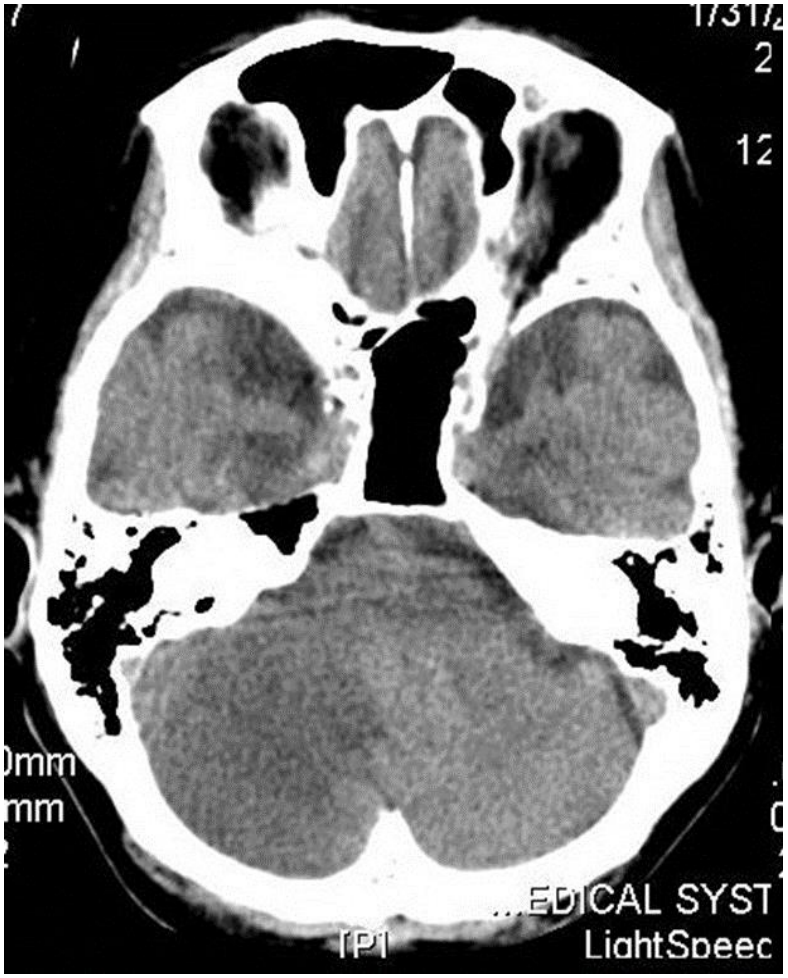


Medullary infarct on diffusion-weighted imaging


Hypoglossal Nucleus
Medial Vestibular Nucleus
Dorsal Vagal Nucleus
Fourth Ventricle
Nucleus of Tractus Solitarius
Posterior Cochlear Nucleus
Inferior Cerebellar Peduncle
Inferior Vestibular Nucleus
Nucleus Ambiguus
Trigeminal Nerve Nucleus and Spinal Tract
Dorsal accessory olivary nucleus
Anterior Spino-cerebellar tract
Anterior Cochlear Nucleus
Medial Longitudinal fasciculus, medial lemniscus
Lateral Spino-cerebellar tract
Tectospinal Tract
Medial Accessory Olivary Nucleus
Pyramid
Arcuate Nucleus
Inferior Olivary Nucleus

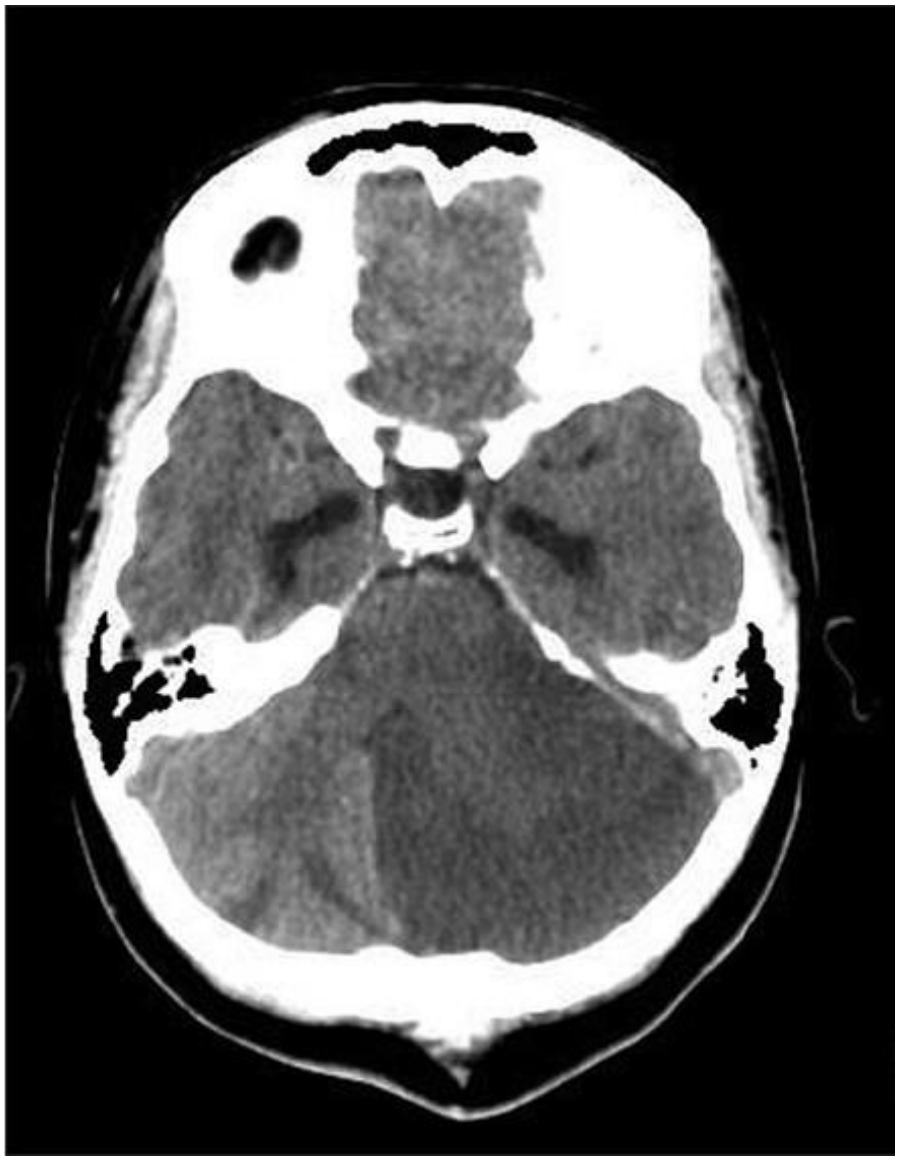
Cerebellar stroke

- 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:

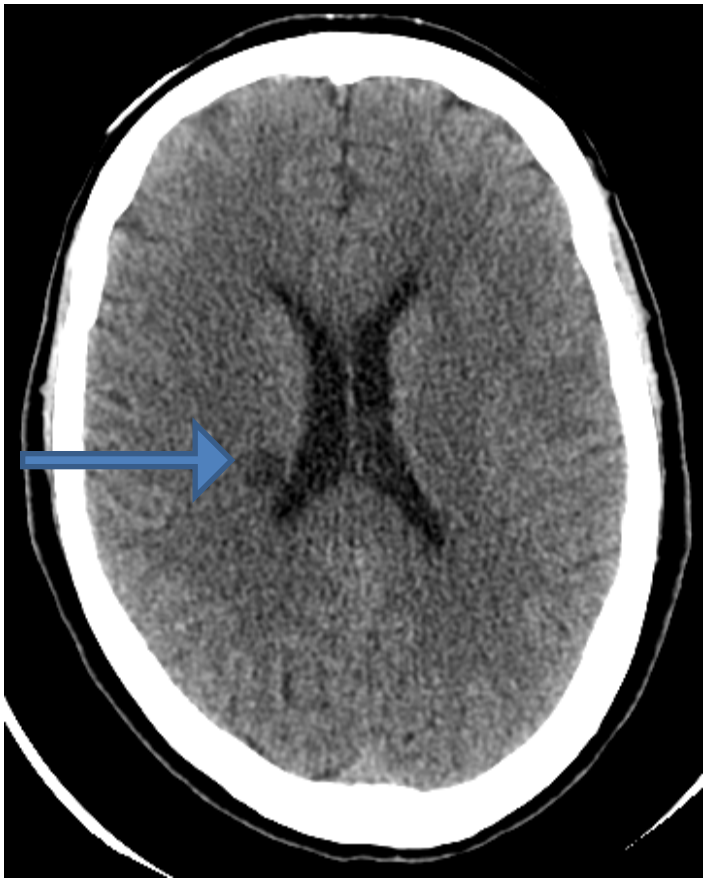
- **Pure sensory stroke** usually arises from thalamic infarction

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

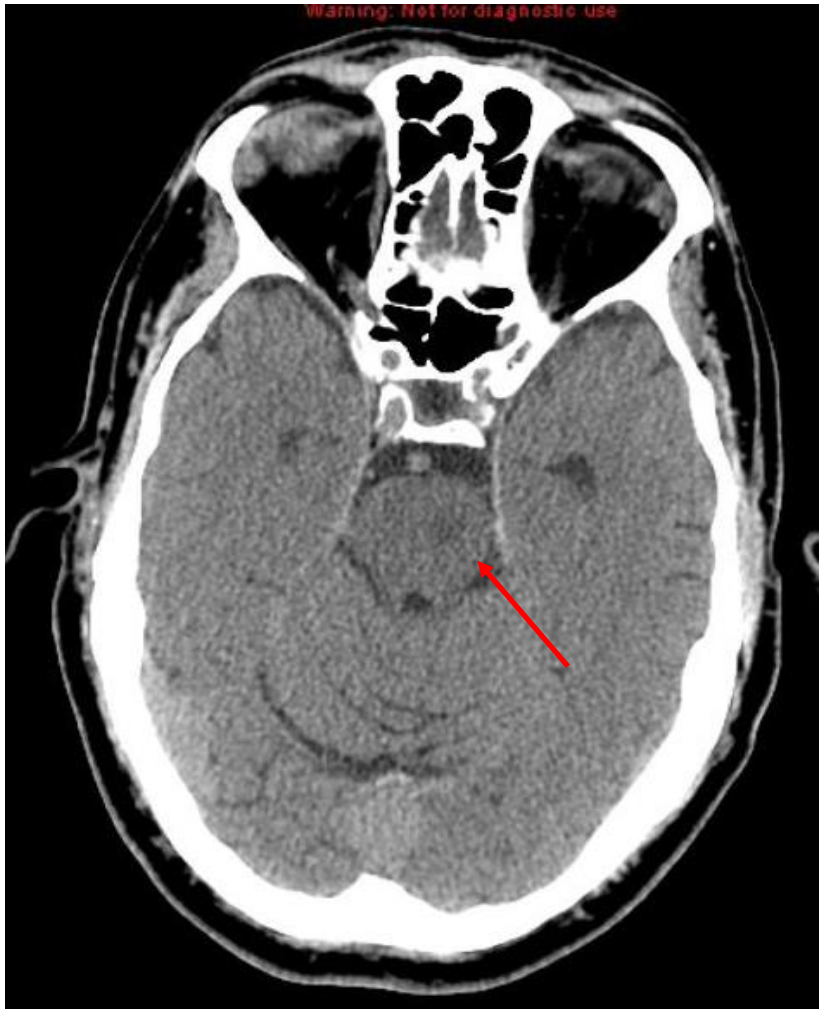
Lacunar stroke syndromes

- **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



What to expect with hemorrhagic stroke

- Deficits are based on the location of the lesion as in ischemic stroke
- But the clinical course can change very quickly if the hematoma expands, which happens in about 30% of cases within the first day

Intracerebral hemorrhage has high mortality

- About a third will die in the first month

- Age is a major factor with over 50% mortality in patients > 80 yo

Mortality after hemorrhagic stroke
Antonio González-Pérez, David Gaist, Mari-Ann Wallander, GillianMcFeat, Luis A. García-Rodríguez
Neurology Aug 2013, 81 (6) 559-565

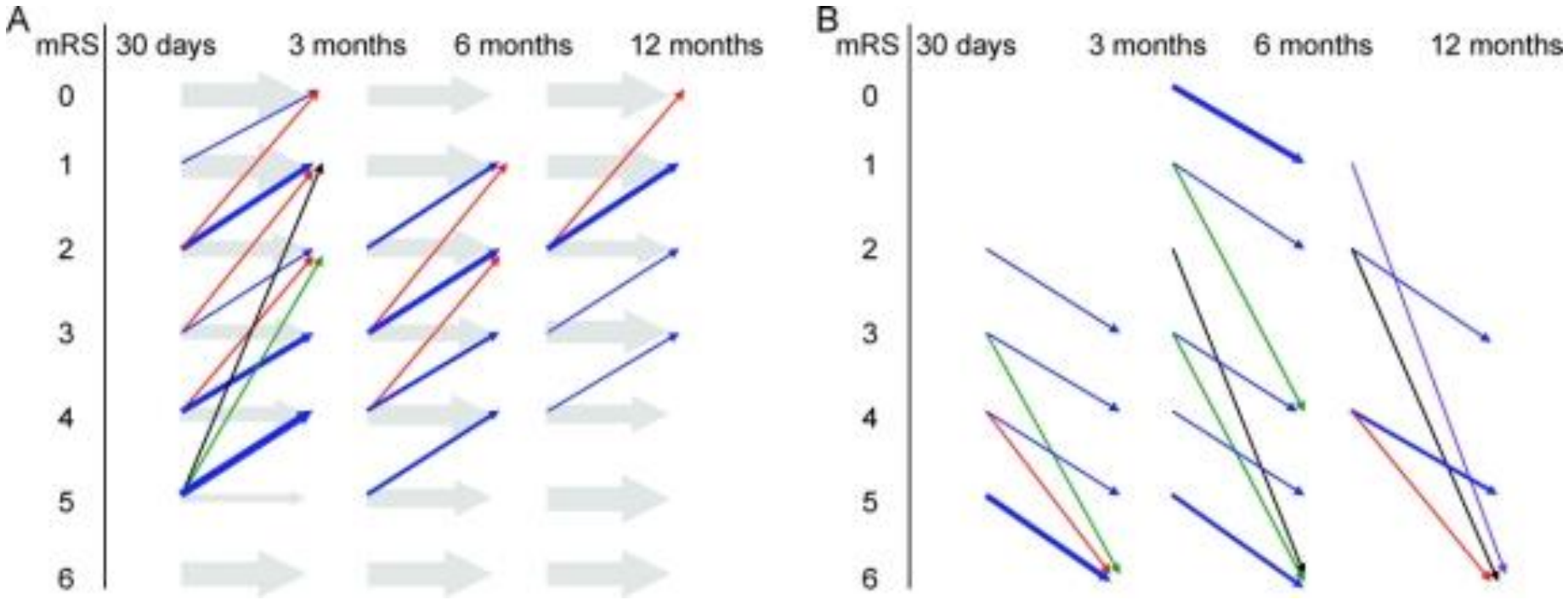
Recovery is slow

Table 2 **Modified Rankin Scale (mRS) score at various timepoints (n = 243)**

mRS score	Hospital discharge	30 d	3 mo	6 mo	12 mo
0	3 (1)	3 (1)	5 (2)	4 (2)	5 (2)
1	21 (9)	25 (10)	29 (12)	32 (13)	35 (14)
2	13 (5)	15 (6)	17 (7)	21 (9)	16 (7)
3	31 (13)	27 (11)	31 (13)	29 (12)	31 (13)
4	55 (23)	55 (23)	42 (17)	36 (15)	26 (11)
5	25 (10)	18 (7)	8 (3)	7 (3)	13 (5)
6	95 (39)	100 (41)	111 (46)	114 (47)	117 (48)

Values are expressed as n (%).

Hemphill JC 3rd, Farrant M, Neill TA Jr. Prospective validation of the ICH Score for 12-month functional outcome. Neurology. 2009 Oct 6;73(14):1088-94. doi: 10.1212/WNL.0b013e3181b8b332. Epub 2009 Sep 2. PMID: 19726752; PMCID: PMC2764394.



- Grey: no improvement
- Blue: mRS improved by 1
- Line thickness indicates # patients

Brizzi *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2012, **20**:36
http://www.sjtrem.com/content/20/1/36

SCANDINAVIAN JOURNAL OF
trauma, resuscitation
& emergency medicine

ORIGINAL RESEARCH Open Access

Early do-not-resuscitate orders in intracerebral haemorrhage; frequency and predictive value for death and functional outcome. A retrospective cohort study

Marco Brizzi[1*], Kasim Abul-Kasim[2], Mattis Jalakas[1], Eufrozina Selariu[2], Hélène Pessah-Rasmussen[1] and Elisabet Zia[1]

- DNR: Do Not Resuscitate
  - No CPR, no defibrillation, no intubation
- Reviewed 197 cases

Early DNR order predicts death

- Intracerebral hemorrhage carries a one month mortality rate of around 40% in developed countries
- Independent predictors of death at one month include: age > 74 yo, hematoma volume > 30 mL, and DNR order within 48 hours of hospital admission
- **DNR order almost quadrupled the odds of dying**

Part 2 Outline

- **Stroke Unit Care:**
  - Seizure
  - Fever
  - DVT prophylaxis
  - Mobility
  - Continence and UTI
  - Nutrition
  - Aspiration, pneumonia and oral care

The Goal of Stroke Unit Care

- The ultimate goal is to ensure that the person who has become disabled by stroke will return to their optimal level of health and activity within the limits of any persisting stroke impairment.

Stroke Recovery and Rehabilitation Approaches

- **Restoration** and repair of bodily function
- **Compensation** and increasing function despite impairment
- **Environmental modification** to increase activity and participation
- **Prevention of complications**
- **Prevention of deterioration**

Medical Complications in the Stroke Unit

- Fever
- Pain
- Aspiration and chest infection
- Progressing or fluctuating stroke
- UTI
- Seizures
- DVT/PE
- Falls
- Pressure sores
- Myocardial infarction and arrhythmias

Canadian Best Practice Recommendations for Stroke

- http://www.strokebestpractices.ca/

Seizure

- Occurs in about 1 to 3% of acute ischemic stroke admissions
- If a single seizure, can treat with short-acting medications such as lorazepam
  - No need to start long-term anticonvulsant

Fever

- Temperature should be monitored as part of routine vital sign assessments, every four hours for first 48 hours and then as per ward routine or based on clinical judgment [Evidence Level C].
- For temperature greater than 37.5° Celsius, increase frequency of monitoring, initiate temperature-reducing measures, investigate possible infection such as pneumonia or urinary tract infection [Evidence Level C], and initiate antipyretic and antimicrobial therapy as required [Evidence Level B].

Fever is associated with poor stroke outcome

- Patients with T > 37.9 ^{o}C are more likely to die within the first ten days
  - Azzimondi et al. *Stroke.* 1995;26:2040-2043
- Fever is associated with worse stroke severity, greater infarction size and worse outcome.
- Mild hypothermia is associated with a better outcome
  - Reith et al. *Lancet*. 1996 Feb 17;347(8999):422-5

DVT Prophylaxis

- Assess for high risk:
  - Unable to move lower limb, or mobilize independently
  - Previous history of DVT
  - Dehydration
  - Cancer
- Every patient should be mobilized and hydrated

DVT Prophylaxis, continued

- Patients at high risk of venous thromboembolism should be started on thigh-high intermittent pneumatic compression devices (IPC) or pharmacological venous thromboembolism prophylaxis immediately if there is no contraindication (e.g. systemic or intracranial hemorrhage) [Evidence Level A]. At present, there is no direct evidence to suggest the superiority of one approach over the other.

Mobility

- Within 24 hours, mobilize the patient unless contraindicated:
  - Move in bed, sit up, stand, eventually walk
  - Don’t move if medically unstable, low oxygen saturation, lower limb fracture or injury
- All patients admitted with acute stroke should be assessed by rehab professionals within 48 hours

Continence

- All patients to be screened
- Use the bladder scanner
- Remove Foley catheter as early as reasonable
- Bowel management program is also important in patients with persistent constipation or bowel incontinence

Urinary Tract Infection

- Indwelling catheter will increase the risk of infection substantially
- UTI is an independent risk factor for a poor stroke outcome
- **UTI doubles to triples the chance of LOSING INDEPENDENCE at 3 months**

European Journal of Neurology 2008, **15:** 1324–1331

European Journal of Neurology 2004, **11:** 49–53

Nutrition and Dysphagia

- Dysphagia, nutrition and hydration should be screened ideally on admission
- Refer to dietitian for all patients with nutrition concerns, hydration deficits, dysphagia or comorbidities that affect nutrition (diabetes, etc)
- Consider tube feeding within 3 days in patients who can’t meet nutrient/fluid requirements orally

Aspiration and pneumonia

- Aspiration is extremely common and often difficult to detect at the bedside
- In one study, 42% of stroke patients were found to have aspirated on video fluoroscopy within 72 hours of admission to hospital
- Only 20% of these cases were detected at the bedside
- Aspiration is a clear risk factor for developing pneumonia

Pneumonia kills stroke patients

- Pneumonia **doubles to quadruples** the chance of **DYING** within three months after stroke
- Pneumonia **triples to quadruples** the chance of **LOSING INDEPENDENCE** within three months after stroke
- But fortunately, pneumonia is **PREVENTABLE**

European Journal of Neurology 2004, **11:** 49–53

European Journal of Neurology 2008, **15:** 1324–1331

Raise the head of the bed

- In one study of ventilated patients, raising the head of the bed to 45 degrees decreased the incidence of clinically suspected pneumonia from **34% to 8%**
- The incidence of microbiologically confirmed pneumonia was reduced from **23% to 5%**
  - Lancet 1999; 354, 1851-8

Oral Care

- Upon or soon after admission, all stroke patients should have an oral/dental assessment, including screening for signs of dental disease, level of oral care, and appliances [Evidence Level C].
- For patients wearing a full or partial denture it should be determined if they have the neuromotor skills to safely wear and use the appliance(s) [Evidence Level C].

Everyone has a dirty mouth

- Lake Ontario beaches are shut down when there is **ONE** E.coli organism per millilitre of lake water

- In one millilitre of saliva there are:

- **600 different bacterial species**
- **100,000,000 bacterial organisms**

Good oral care may save lives

- Aspiration pneumonia often occurs in patients who are NPO
- Some are aspirating on their gastric contents
- Some are aspirating on their own saliva, which carries a large load of bacteria
- In one Japanese study in nursing homes, brushing teeth decreased the incidence of pneumonia by **50%** and for those patients who did get pneumonia, mortality was reduced by **50%**.

- **1:** J Neurosci Nurs. 2008 Oct;40(5):291-8.
- **Oral care intervention to reduce incidence of ventilator-associated pneumonia in the neurologic intensive care unit.**
- **Fields LB**.
- Neurosurgical Unit, Summa Health Systems, Akron, OH, USA. fieldsl@summa-health.org

Intensive Care Med (2006) 32:230–236
DOI 10.1007/s00134-005-0014-4

ORIGINAL

Hideo Mori
Hiroyuki Hirasawa
Shigeto Oda
Hidetoshi Shiga
Kenichi Matsuda
Masataka Nakamura

Oral Care Reduces Incidence of Ventilator-Associated Pneumonia in ICU Populations

Last word

- **Because the patient has a stroke, the impact of what you do is magnified.**

- **The Stroke Unit is a place where the dozens of “routine things” that are done by a nurse, physiotherapist, occupational therapist, dietitian, speech language pathologist, or doctor MAKE A BIG DIFFERENCE**

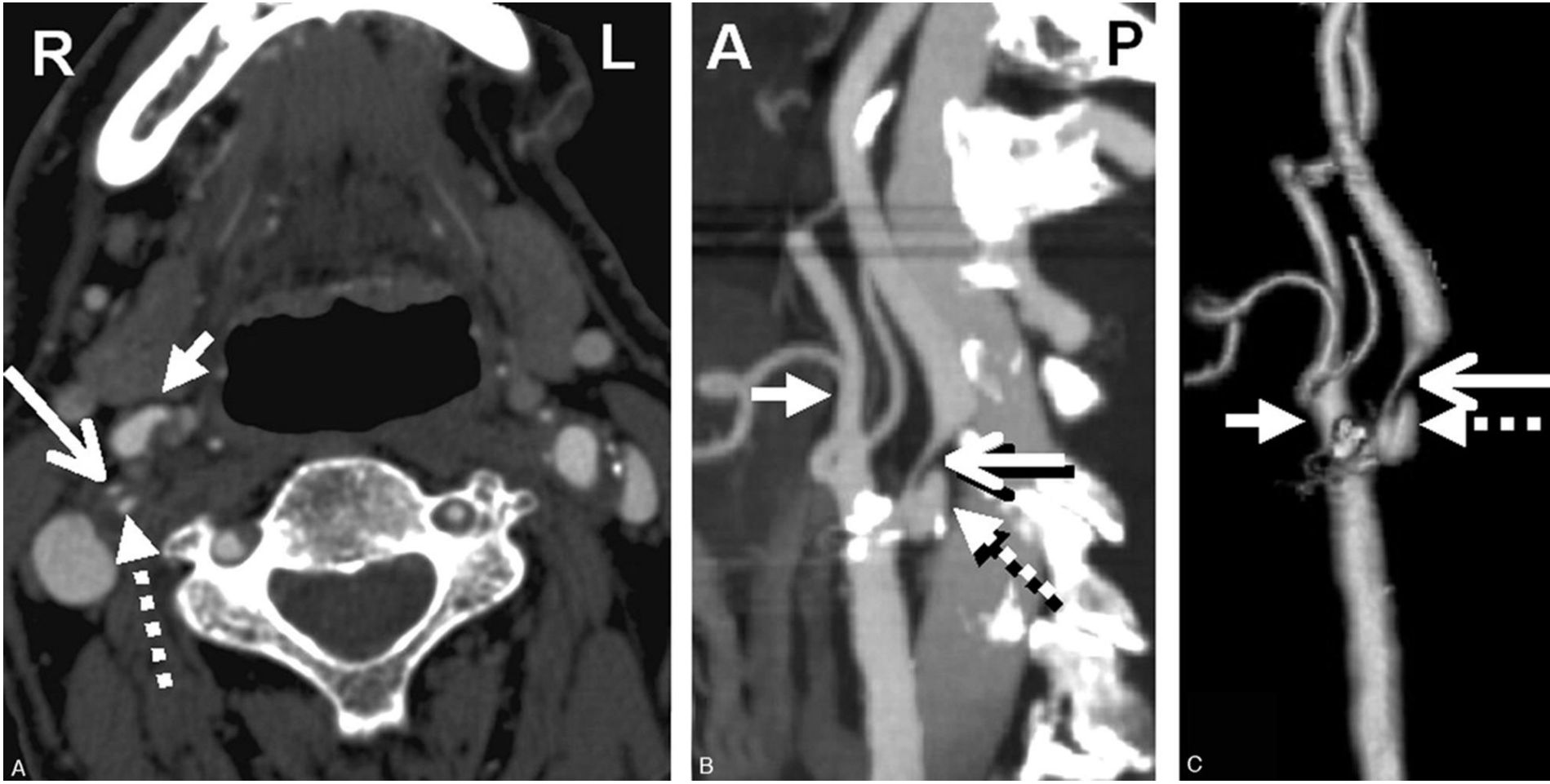
Part 3 Outline

- Doing the right tests for each stroke subtype
  - Large artery atherosclerotic disease
  - Small vessel ischemic disease
  - Cardioembolism
  - Other
  - Cryptogenic
- What should you put in to your discharge summary?

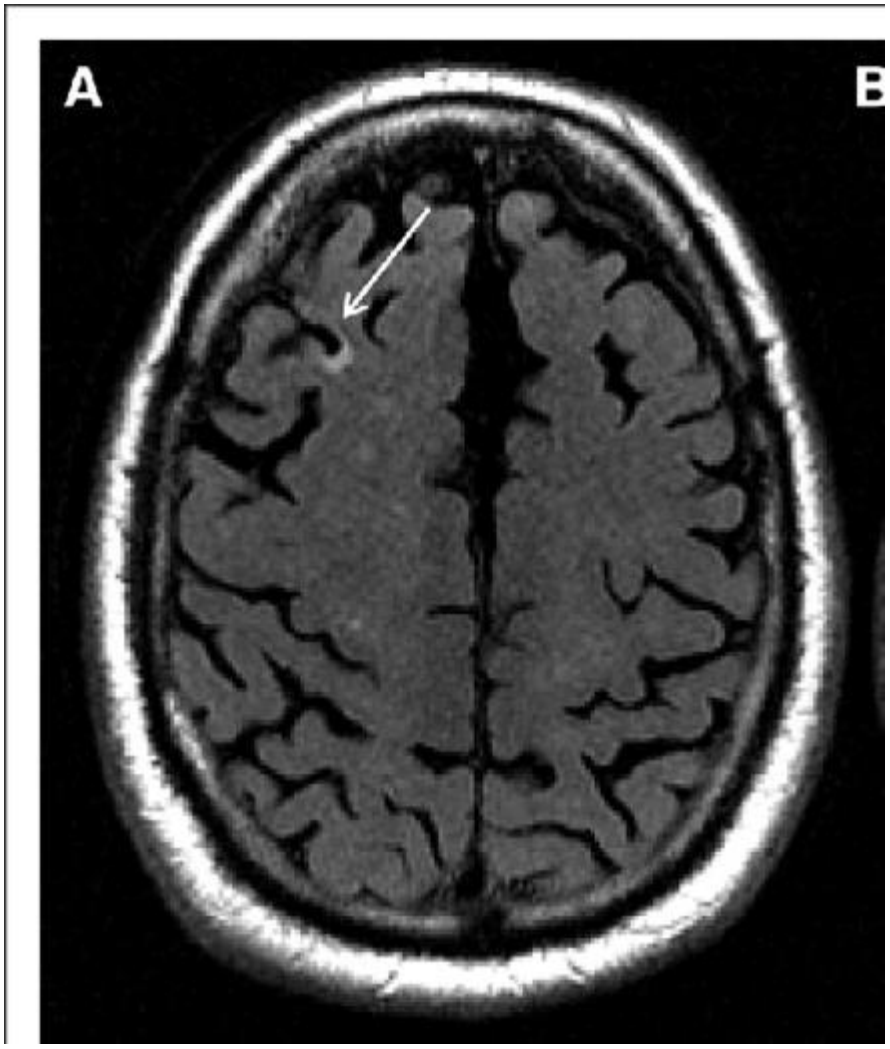
The Five Stroke Etiological Categories

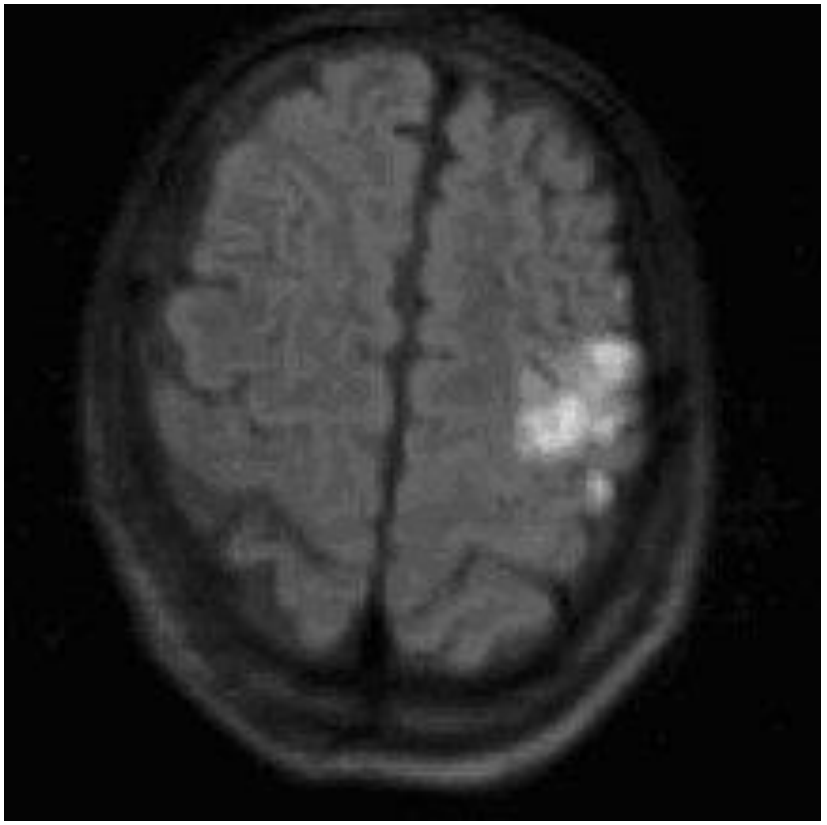
- Large artery atherosclerotic disease
- Small vessel ischemic disease
- Cardioembolism
- Other: vasculitis, antiphospholipid antibody syndrome, dissection
- Cryptogenic

- **Large artery atherosclerotic disease (15% of all ischemic strokes)**
  - Stenosis of 50% or greater in a blood vessel that you can see on CT angiography, MR angiography, or conventional angiography
- Every stroke patient should have vascular imaging before discharge from hospital
  - CTA is preferred
  - Carotid Doppler is second choice
  - MR angiography is not as accurate in general as CTA

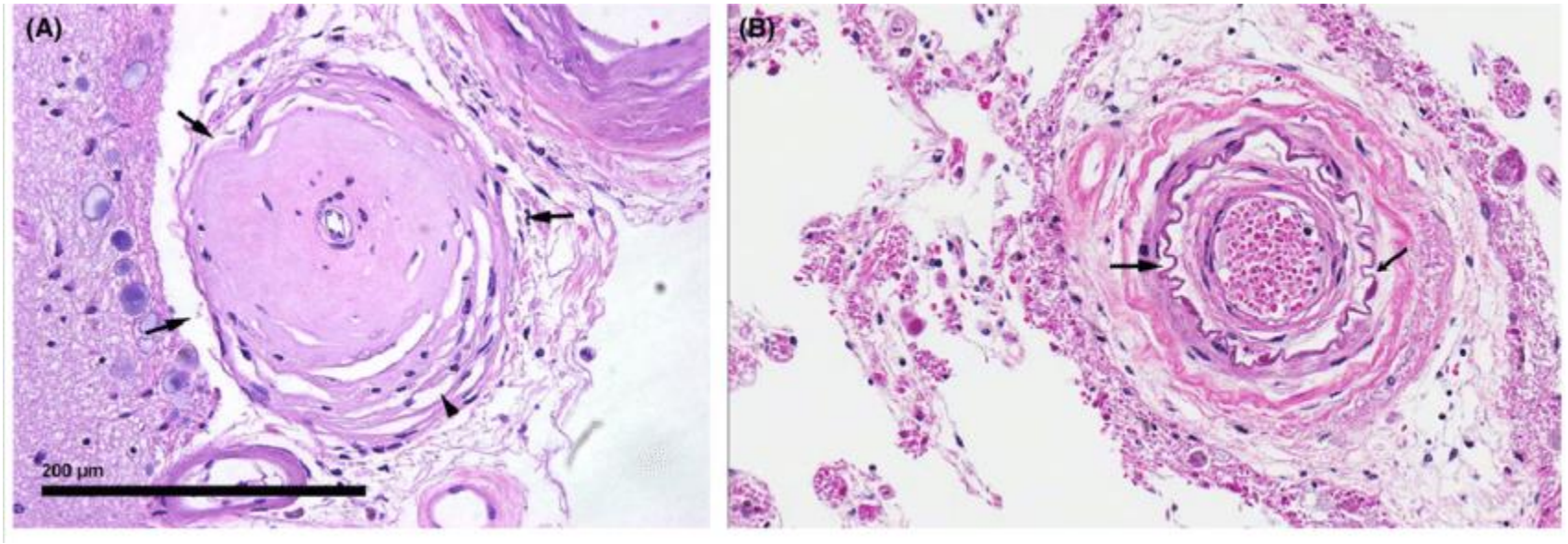


Quantification of Carotid Stenosis on CT Angiography
E.S. Bartlett, T.D. Walters, S.P. Symons, A.J. Fox
American Journal of Neuroradiology Jan 2006, 27 (1) 13-19;

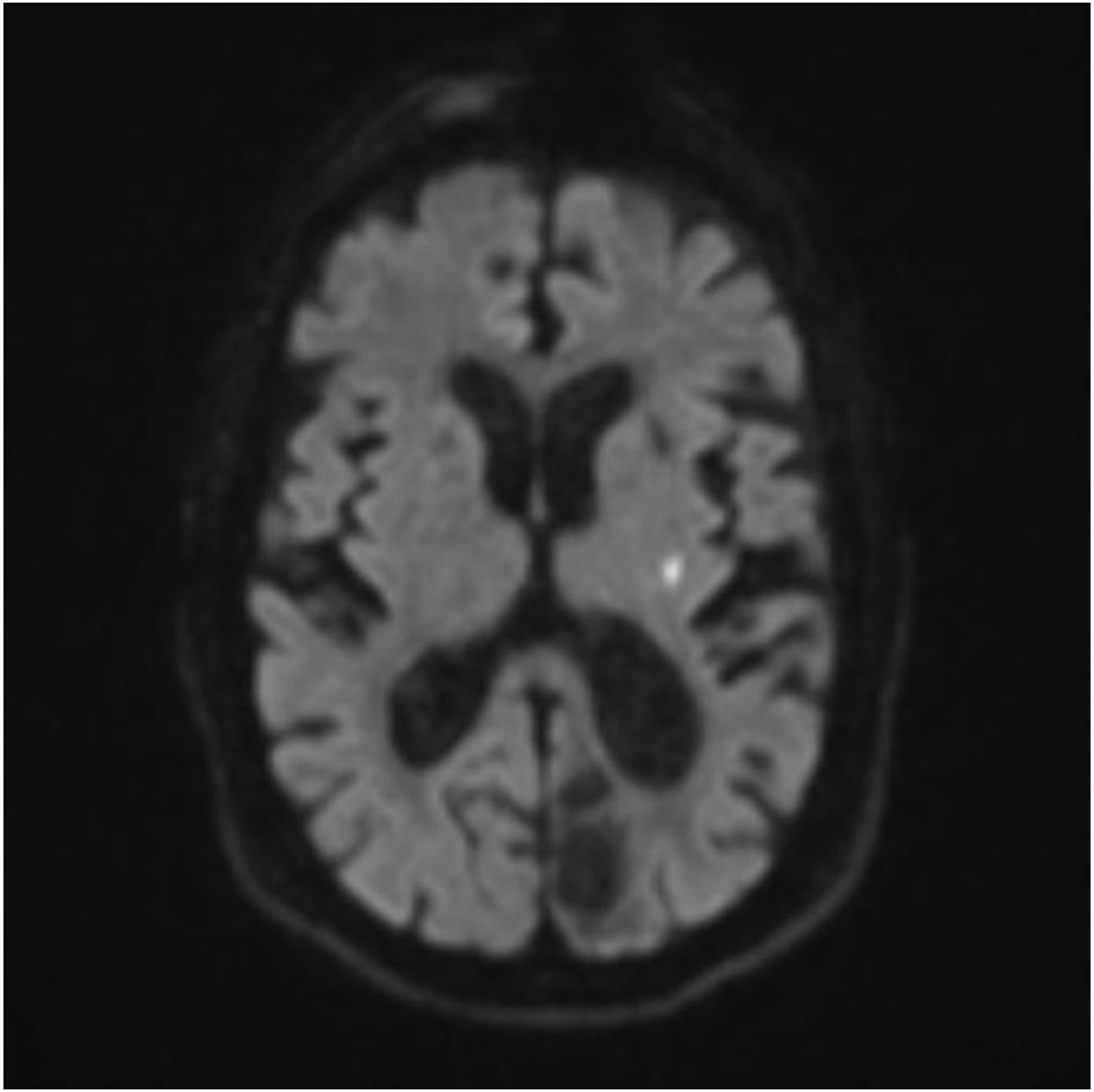

A
B



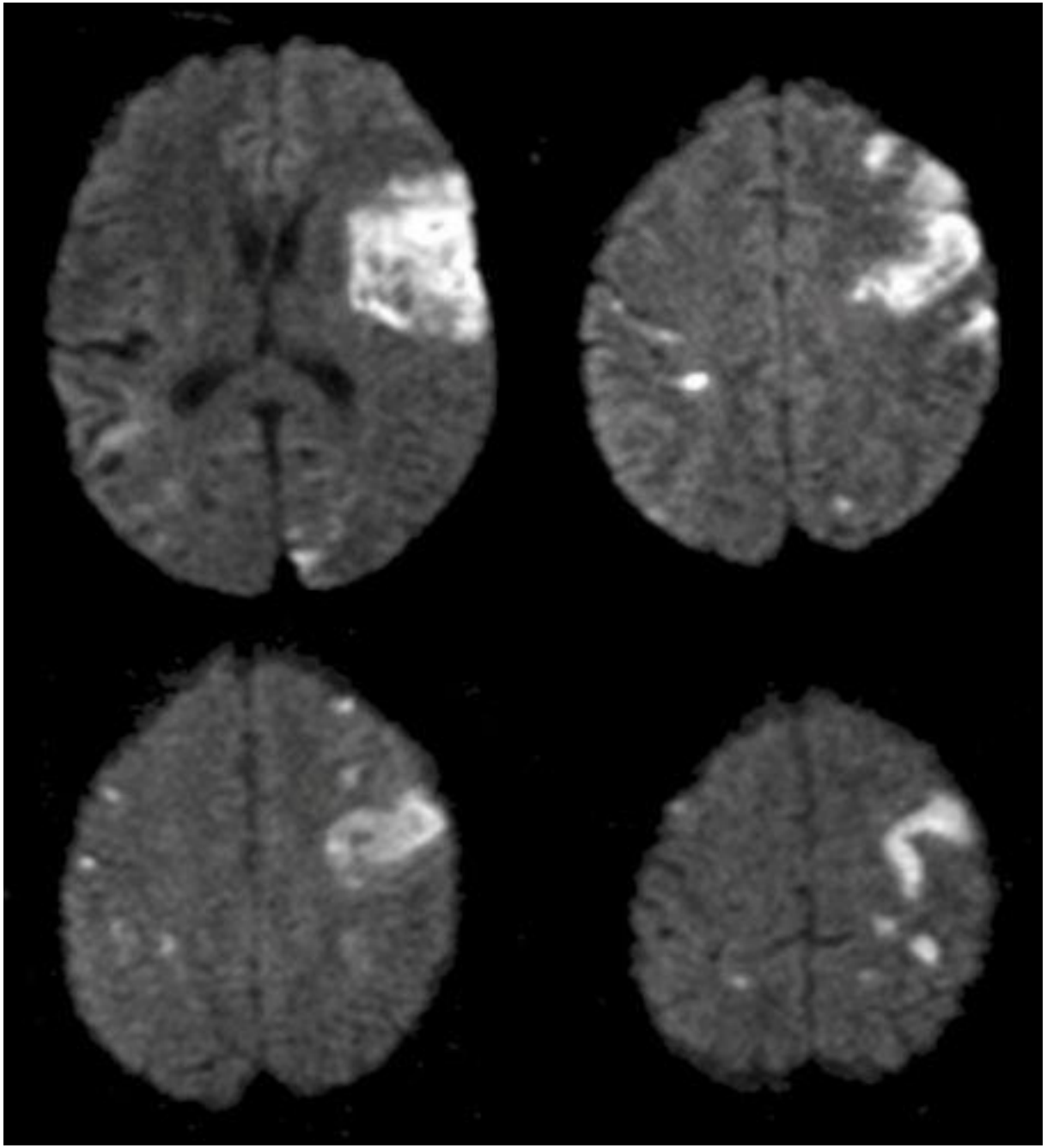
- **Small vessel ischemic disease (~25% of all ischemic strokes)**
  - This involves vessels that are 20 to 200 microns in diameter and generally too small to see on imaging
  - These are not embolic events
  - When the stroke is a single lacunar infarct that is small (less than 15 mm in longest dimension) with a classic lacunar presentation then it's not necessary to do an echo or Holter
  - If the subcortical infarct is large then you have to investigate for an embolic source



Vinters, Harry & Zarow, Chris & Borys, Ewa & Whitman, Jeffrey & Tung, Spencer & Ellis, William & Zheng, Ling & Chui, Helena. (2018). Vascular dementia: clinicopathologic and genetic considerations. Neuropathology and Applied Neurobiology. 44. 10.1111/nan.12472.

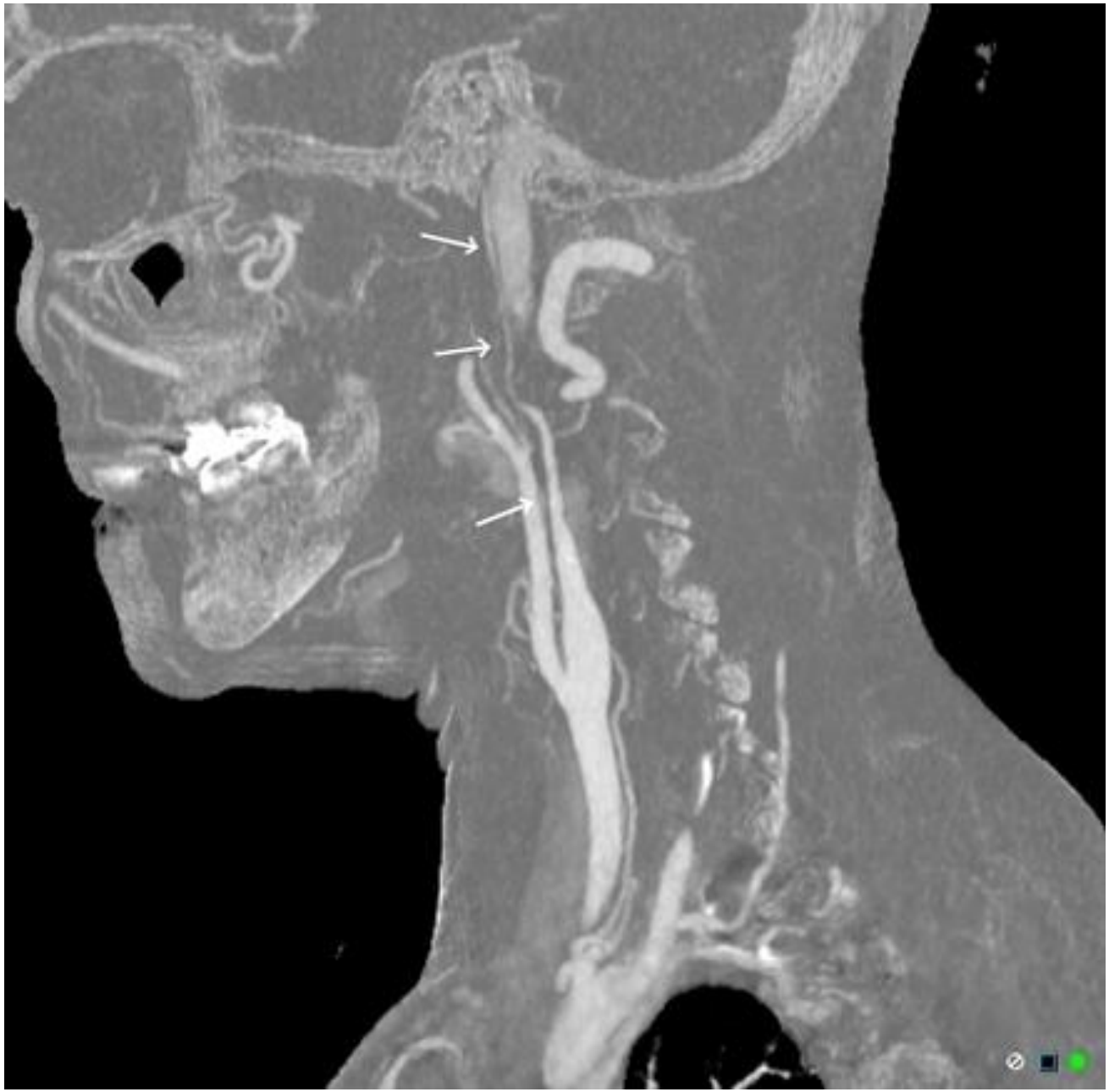


- **Cardioembolism (~ 30% of all ischemic strokes)**
  - The vast majority of these are due to atrial fibrillation
  - Also can have these from many other cardiac sources
    - Endocarditis
    - LV hypokinesis
    - Apical akinesis
  - Need to do echo and 14 day Holter monitor if suspicious



- **Other causes (~5 to 15% of ischemic strokes)**
  - Vasculitis is rare
  - Arterial dissection is common
  - Antiphospholipid antibody syndrome:
    - Anticardiolipin antibody
    - Lupus anticoagulant
    - Anti-beta-2-glycoprotein 1 antibody

ICA dissection after neck manipulation



- **Cryptogenic:**
  - Can’t find a cause after doing all the tests
  - Two or more equally likely causes
  - Didn’t complete the investigation for some reason
  - Many of these patients have a PFO
    - Should you recommend PFO closure?

thebmj

RAPID RECOMMENDATIONS

Patent foramen ovale closure, antiplatelet therapy or anticoagulation therapy alone for management of cryptogenic stroke? A clinical practice guideline

Ton Kuijpers,[1] Frederick A Spencer,[2] Reed A C Siemieniuk,[3 4] Per O Vandvik,[5 6] Catherine M Otto,[7] Lyubov Lytvyn,[2] Hassan Mir,[2] Albert Y Jin,[8] Veena Manja,[9] Ganesan Karthikeyan,[10] Elke Hoendermis,[11] Janet Martin,[12] Sebastian Carballo,[13] Martin O'Donnell,[14] Trond Vartdal,[15] Christine Baxter,[16] Bray Patrick-Lake,[17] Joanie Scott,[18] Thomas Agoritsas,[3 19] Gordon Guyatt[2 3]

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doi: 10.1136/bmj.k2515

https://www.bmj.com/content/362/bmj.k2515

Discharge Summary

- Should always mention the **territory** or **anatomical regions** involving the infarction
- Should always mention the **mechanism** or **etiology** of the infarction
- Example: “RMCA infarction secondary to thromboembolism arising from RICA atherosclerotic disease with stenosis of 55%”

Discharge Summary - 2

- Example: “Clumsy hand – dysarthria syndrome with infarction in the left frontal corona radiata due to small vessel ischemic disease”

- Example: “Left lateral medullary infarction secondary to cardioembolism caused by atrial fibrillation”

End of Stroke School

- If any questions please feel free to email me at: Albert.Jin@kingstonhsc.ca