

ACUTE STROKE MANAGEMENT

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LET'S SAVE SOME BRAIN TISSUE!!





HI, I'M JOSIE

I'm a third-year neurology resident. My personal goal is to make today feel approachable, helpful, and memorable. I was in your shoes two years ago so I know how overwhelming July can be, but we can do it!



THE PLAN FOR TODAY

1. Understand the basic components of the stroke alert.
2. Verbalize the rationale behind the major decision pathways for acute ischemic strokes treatments.
3. Describe the steps to work-up acute ischemic stroke etiology.
4. Recognize common stroke syndromes.
5. Discuss the initial steps of stabilizing a patient with acute hemorrhagic stroke.

Green background:
Ischemic stroke

You know more
than you think you
know.

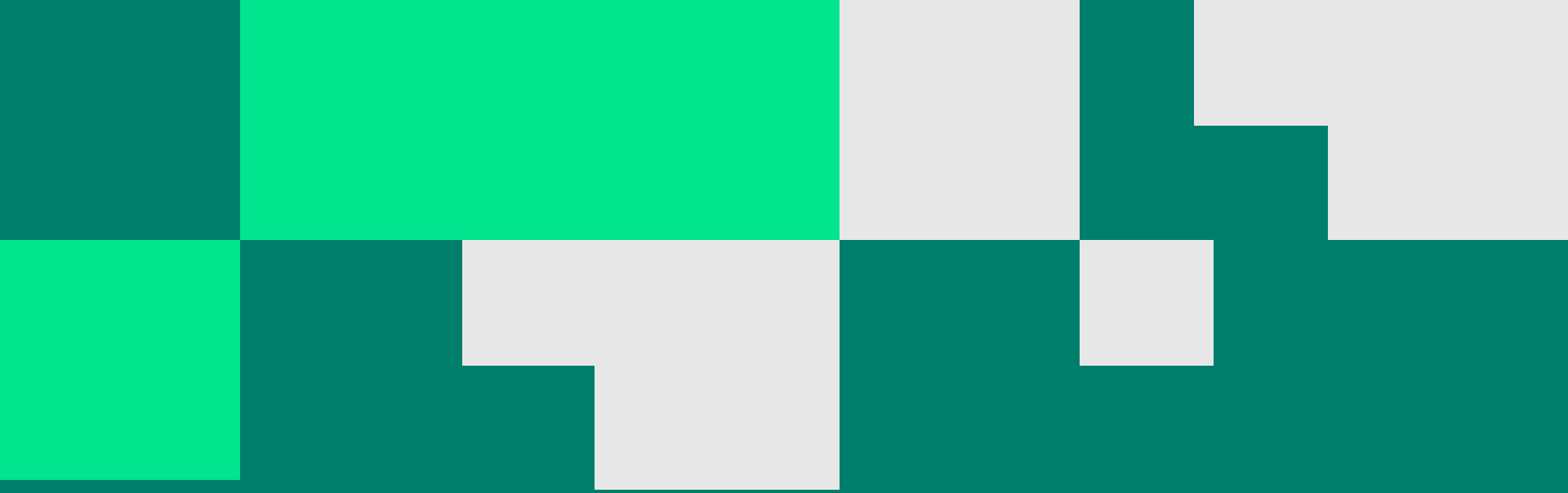
Pink background:
Hemorrhagic stroke

If you don't mind, please save
questions for the end so we have
time to get through all the learning
objectives. Thank you!! :)

Ischemic stroke = brain does not get
enough blood (80% of strokes)

Hemorrhagic stroke = “brain bleed” (20%
of strokes)

Simple Definitions

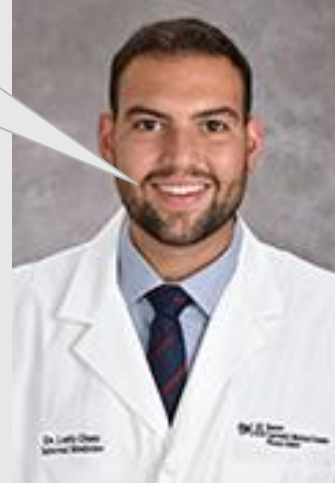


TIME IS BRAIN,
BABY!!

When should I call a stroke alert?

**STROKE
ALERT!**

- 1. Last known well within 24 hours**
 - a. Extended window TNK
 - b. Thrombectomy
- 2. Focal neurologic deficit**



STROKE ALERT!

What's helpful to know when a stroke alert is called?

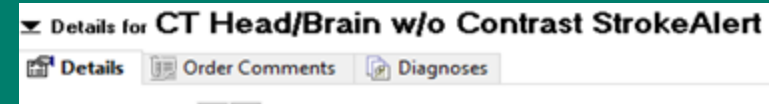
1. Last known well
2. Patient's baseline exam
 - a. Prior strokes?
 - b. Any residual deficits?
3. What are the new symptoms?
4. Any blood thinners?
5. Any recent surgeries?
6. Can the patient consent?



STROKE ALERT!

What are some practical tips to make the stroke alert run smoothly?

1. IV access (18G for contrast)
2. Transport monitor
3. Lift sheet
4. Place orders: "Stroke"
 - a. CT Head w/o contrast
 - b. CTA Head/Neck w/ and w/o contrast



A note about NIHSS

It's a clinical **tool**, but does not make our decisions for us.

- A person with NIH 0 can still get TNK if their deficits are disabling
- A person with an NIH of 25 isn't necessarily having a stroke

NATIONAL INSTITUTES OF HEALTH
stroke scale

CATEGORY	STROKE SCALE	SCORE
1a. Level of consciousness Best, 5 points; 4 points; 3 points; 2 points; 1 point; 0 points	5 4 3 2 1 0	
1b. LOC Questioning Orients to person; 2 points; 1 point; 0 points	2 1 0	
1c. LOC Commands Orients to person; 2 points; 1 point; 0 points	2 1 0	
2. Best Gaze Eyes open; 2 points; 1 point; 0 points	2 1 0	
3. Visual Identifies visual stimuli; 2 points; 1 point; 0 points	2 1 0	
4. Facial Palsy Smile, frown, close eyes, and wiggle nose; 2 points; 1 point; 0 points	2 1 0	
5a Motor Arm - Left Extends arm; 2 points; 1 point; 0 points	2 1 0	
5b Motor Arm - Right Extends arm; 2 points; 1 point; 0 points	2 1 0	
6a Motor Leg - Left Extends leg; 2 points; 1 point; 0 points	2 1 0	
6b Motor Leg - Right Extends leg; 2 points; 1 point; 0 points	2 1 0	
7. Limb Ataxia Finger to nose; 2 points; 1 point; 0 points	2 1 0	
8. Sensory Finger to face, arm, hand, and leg; 2 points; 1 point; 0 points	2 1 0	
9. Best Language Name, count, copy, and read; 2 points; 1 point; 0 points	2 1 0	
10. Dysarthria Repeats words; 2 points; 1 point; 0 points	2 1 0	
11. Extinction and Inattention Identifies objects; 2 points; 1 point; 0 points	2 1 0	

NIH = National Institutes of Health

NIH = 0 = No stroke; 1 = Minor stroke; 2 = Moderate stroke; 3 = Severe stroke; 4 = Very severe stroke; 5 = Critical stroke

TOTAL =

A 66-year-old woman is evaluated in the emergency department for sudden-onset right-sided weakness that started 2 hours ago. Medical history is relevant for hypertension. Medications are amlodipine and chlorthalidone.

On physical examination, blood pressure is 168/78 mm Hg, pulse rate is 86/min, and respiration rate is 12/min. Visual fields are full. The patient exhibits right facial weakness and mild dysarthria. Strength is 3/5 throughout the right arm and 4/5 throughout the right leg. National Institutes of Health Stroke Scale score is 5. No aphasia or sensory loss is present.

Which of the following is the most appropriate diagnostic test to perform next?

A CT of the head with contrast

abc

B CT of the head without contrast

abc

C CT perfusion imaging

abc

D MRI of the brain

abc

Thrombolysis?

We use
tenecteplase
(TNK)

24 hours at BUMCP!!



1. **tPA** works by transforming plasminogen into plasmin, leading to fibrinolysis of the clot
> types include alteplase (old) and tenecteplase (new)

2. **Tenecteplase (TNK)** is a modified form of human tissue plasminogen activator: higher rate of perfusion and better functional outcome than alteplase in patients with LVO

3. Guidelines have been extended to **9 hours** (based on CTP/MRI findings)

Absolute Contraindications

Are they going
to bleed and
die if I give
them this
medication?

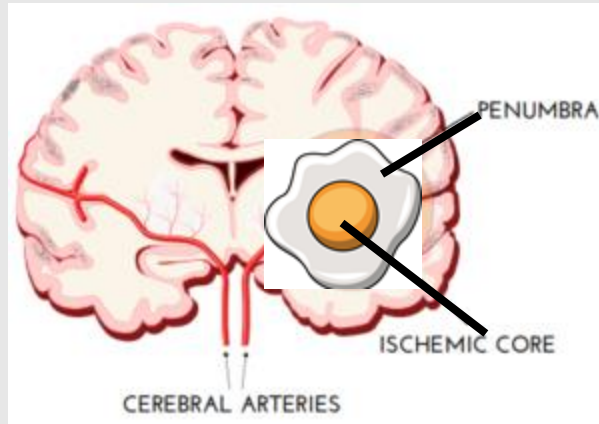
Absolute Contraindications

- Ischemic stroke or severe head trauma in the previous three months.
- Previous intracranial hemorrhage.
- History of intracranial neoplasm.
- Gastrointestinal malignancy or hemorrhage in the previous 21 days.
- Intracranial or intraspinal surgery within the previous three months.
- Subarachnoid hemorrhage.
- Blood pressure ≥ 185 mmHg systolic or ≥ 110 mmHg diastolic.
- Active internal bleeding.
- Infective endocarditis.
- Aortic arch dissection.
- Acute bleeding diathesis, including but not limited to conditions defined as “hematologic”.
- Platelet count $< 100,000/\text{mm}$.
- Current anticoagulant use with an INR > 1.7 , PT > 15 seconds, or aPTT > 40 seconds.
- Low molecular weight heparin (LMWH) use within 24 hours for PE or DVT (not at prophylactic doses).
- Direct thrombin inhibitor, direct factor Xa inhibitor, or glycoprotein IIb/IIIa receptor inhibitor use.
- Evidence of hemorrhage on CT head.
- Extensive regions of hypodensity consistent with irreversible ischemic injury.

Relative Contraindications

- Minor or rapidly improving symptoms.
- Serum glucose <50 mg/dL.
- Serious trauma or major surgery in the previous 14 days.
- History of gastrointestinal bleeding or genitourinary bleeding.
- Seizure at stroke onset.
- Pregnancy.
- Arterial puncture at a noncompressible site in the previous 7 days.
- Large (≥ 10 mm), untreated, unruptured intracranial aneurysm.
- Intracranial vascular malformation.

Thrombectomy?



- > **core** = egg yolk (dead tissue)
- > **penumbra** = egg white (tissue that can be saved)

1. Go into the vessel and get the clot out

2. Good candidates have a small (or no) core and a significantly larger penumbra

3. **Benefit up to 24 hours** from LKW
(DAWN/DEFUSE trials)



A 57-year-old patient is evaluated in the emergency department for acute-onset right-sided weakness that started 30 minutes ago. They have coronary artery disease, hypertension, and type 2 diabetes mellitus. They have had no recent surgery or trauma or previous bleeding. Medications are aspirin, lisinopril, atorvastatin, empagliflozin, and metformin.

On physical examination, blood pressure is 172/86 mm Hg, pulse rate is 76/min, and oxygen saturation is 97% with the patient breathing ambient air. They exhibit right facial weakness, dysarthria, and right arm and leg drift that does not reach the bed. National Institutes of Health Stroke Scale score is 4. They have no aphasia or visual field loss.

A complete blood count, serum electrolyte values, and a blood glucose level are normal.

Noncontrast head CT scan shows no early infarct signs or hemorrhage.

Which of the following is the most appropriate next step in management?

☐ A Aspirin

[abc](#)

☐ B CT angiography of the head

[abc](#)

☐ C Intravenous thrombolysis

[abc](#)

☐ D MRI of the brain

[abc](#)

Ischemic Stroke Work-Up

How do we prevent a stroke from happening again?

TOAST Criteria

Trial of Org 10172 in Acute Stroke Treatment



Stroke Etiologies

1. Large vessel atherosclerosis
2. Cardioembolism
3. Small vessel disease
4. Stroke of other determined etiology
5. Stroke of undetermined etiology



Stroke Work-up

1. CTA Head/Neck
2. Transthoracic ECHO
3. A1c, LDL

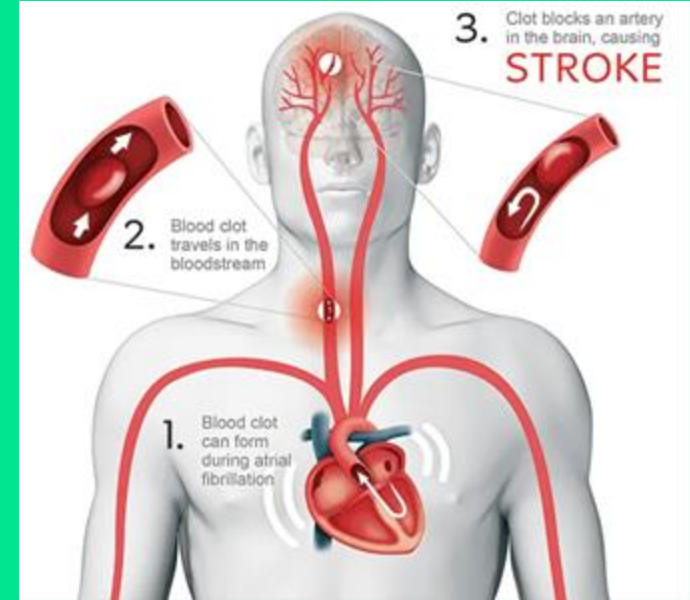
Ischemic Stroke Work-Up

A note about cardioembolism

1. Atrial fibrillation
2. Low ejection fraction
3. Clot from elsewhere crosses PFO (patent foramen ovale)



Consider PFO closure if it's the most likely stroke etiology (for example, in young patients with fewer risk factors)



Treatment = anticoagulation

Ischemic Stroke Work-Up

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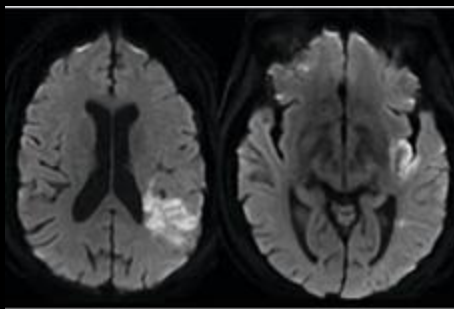
Stroke Work-up

1. CTA Head/Neck
 2. Transthoracic ECHO
 3. A1c, LDL
- + Carotid ultrasound
 - + Transesophageal ECHO
 - + Loop recorder
 - + Thrombophilia panel
 - + Lumbar puncture

A 76-year-old patient is evaluated before hospital discharge following a left parietal and frontal lobe infarct. They have hypertension, type 2 diabetes mellitus, dyslipidemia, and obstructive sleep apnea. Medications are aspirin, clopidogrel, irbesartan, metformin, and atorvastatin.

On physical examination, vital signs are normal. The patient shows right facial weakness and mild difficulties with word finding and following three-step commands. Cardiac examination reveals no carotid bruits or murmurs.

MRI of the brain with diffusion-weighted imaging is shown. CT angiography shows less than 50% stenosis in both extracranial internal carotid arteries and no intracranial arterial stenosis. Hospital telemetry shows no atrial fibrillation. Transthoracic echocardiogram is normal.



Which of the following is the most appropriate management?

- ☐ A Change aspirin and clopidogrel to rivaroxaban abc
- ☐ B Change clopidogrel to ticagrelor abc
- ☐ C Perform continuous ambulatory ECG monitoring abc
- ☐ D Perform transesophageal echocardiography abc

Major Stroke Syndromes

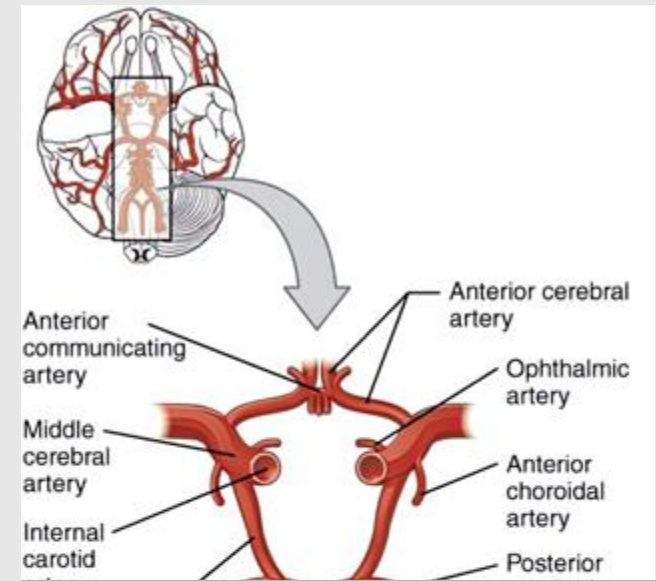
Do I need to know these?

You probably don't need to know these in extreme detail, so we'll review them quickly! :)



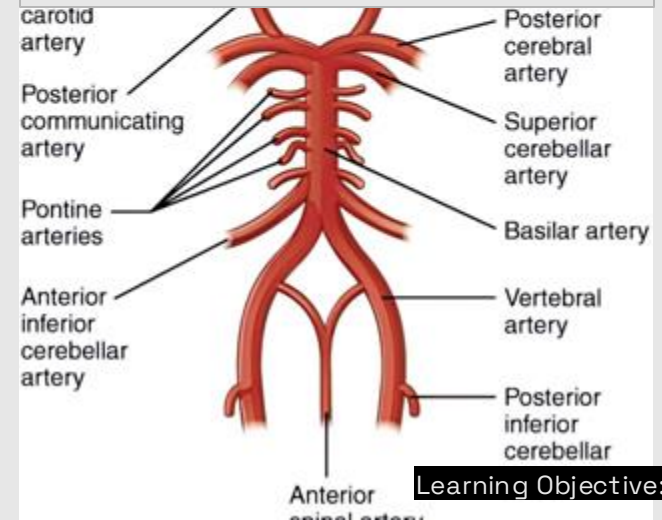
Anterior Circulation

- **Anterior cerebral artery:**
contralateral weakness and numbness of the lower extremity, incontinence, abulia
- **Middle cerebral artery:**
contralateral face/arm weakness/numbness, global aphasia, contralateral homonymous hemianopia, neglect, and ipsilateral gaze preference

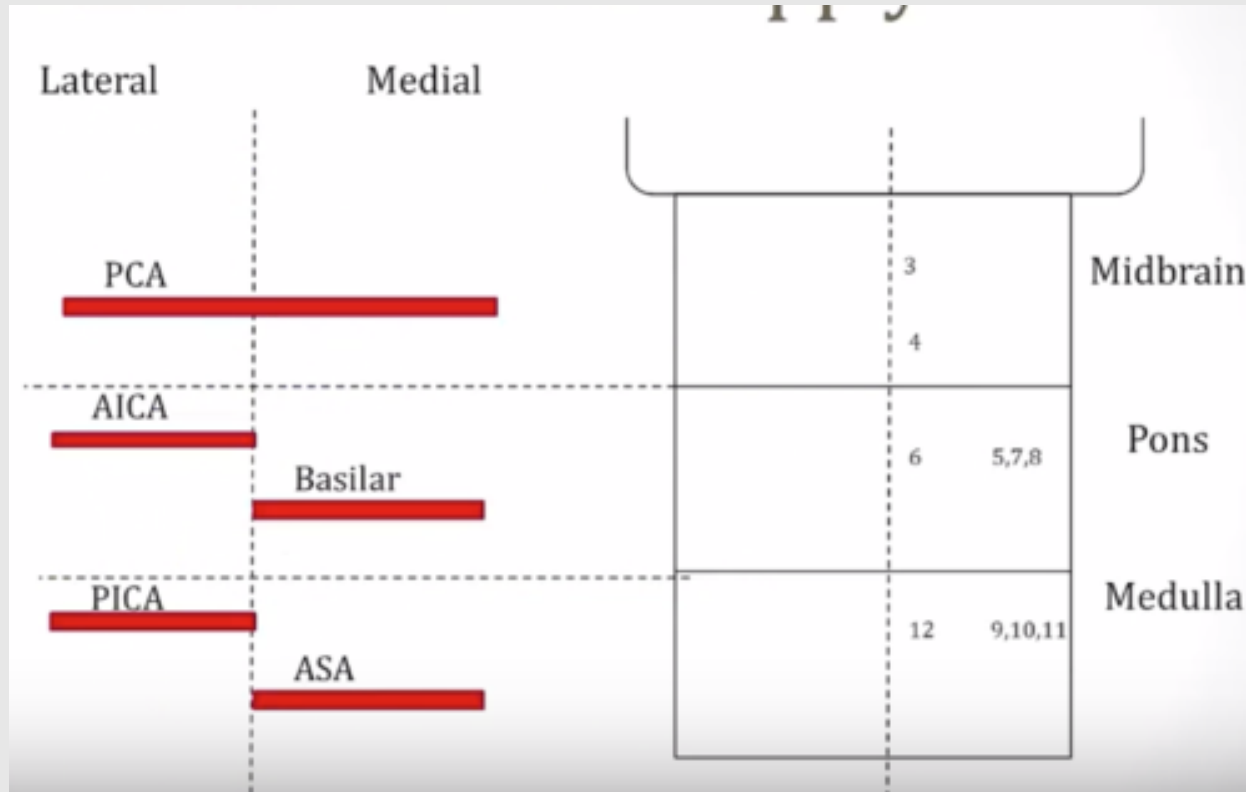


Posterior Circulation

- **Posterior cerebral artery:**
contralateral homonymous hemianopia, memory loss, visual agnosia, and/or prosopagnosia
- **Anterior spinal artery:**
quadriparesis, loss of pain and temperature distal to the lesion
- **Top of basilar:** transient loss of consciousness, oculomotor disturbances, hemianopia, bilateral ptosis, pupillary enlargement with preserved reaction to light



Brainstem Strokes: Rule of 4s



High Yield Cerebral Blood Vessels

Vascular Territory	Symptoms
MCA	Expressive/receptive aphasia (dominant hemisphere), contralateral homonymous hemianopia, ipsilateral gaze preference, contralateral face/arm weakness, contralateral sensory loss
ACA	Contralateral leg > arm sensorimotor deficits, incontinence, abulia, transcortical motor aphasia (dominant hemisphere)
PCA	Contralateral homonymous hemianopia, memory loss, variable anomia or transcortical sensory aphasia, disorientation, alexia without agraphia (dominant hemisphere)
SCA	Ipsilateral limb and truncal ataxia, nausea/vomiting, slurred speech, variable ipsilateral Horner syndrome, contralateral pain/temperature sensory loss
AICA	Ipsilateral ataxia, ipsilateral tinnitus and hearing loss, contralateral pain/temperature sensory loss, ipsilateral facial weakness, variable horizontal gaze defects
PICA	Ipsilateral ataxia, ipsilateral face pain/temp sensory loss, contralateral body pain/temp sensory loss, nystagmus, nausea/vomiting, hoarseness and dysphagia, ipsilateral Horner's
Top of Basilar	Transient loss of consciousness (coma), oculomotor disturbances, hemianopia, bilateral ptosis, and pupillary enlargement with preserved reaction to light
Anterior Choroidal	Contralateral body sensorimotor deficits, contralateral homonymous hemianopia
Lacunar Syndromes	1. Pure contralateral motor hemiplegia 2. Pure contralateral sensory loss 3. Mixed contralateral sensorimotor loss 4. Clumsy hand-dysarthria 5. Ipsilateral hemiparesis-ataxia

A 32-year-old woman is evaluated in the emergency department for sudden-onset vomiting, imbalance, hoarseness, and difficulty swallowing that began 2 hours ago. She also reports sharp jolts of pain on the right side of her face and the left side of her body. She has not had any trauma or surgery. She has no other medical problems and takes no medications.

On physical examination, she has tachycardia; otherwise, vital signs are normal. Ptosis, miosis, and anhidrosis are present on the right. There is loss of pain and temperature sensation on the right side of her face and deviation of the uvula to the left. There is also loss of temperature sensation on the left arm, trunk, and leg. Dysmetria (past-pointing) is evident in the right arm. The rest of the neurologic and physical examination is normal.

Brain MRI is pending.

What is the most likely diagnosis?

A

Brainstem stroke

abc

B

Cavernous sinus thrombosis

abc

C

Internal carotid artery dissection

abc

D

Pancoast tumor

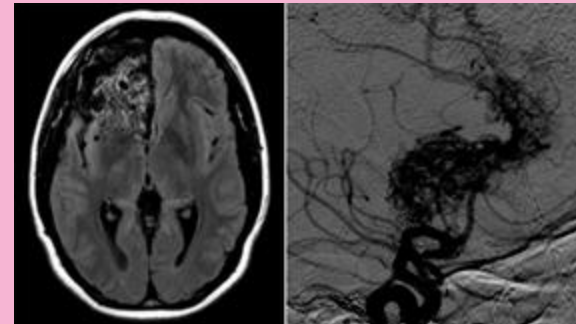
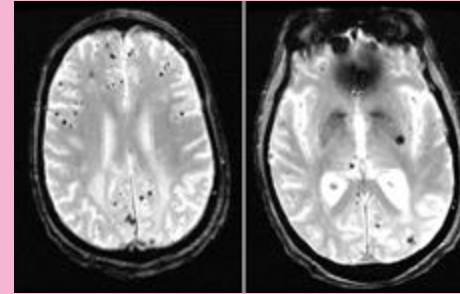
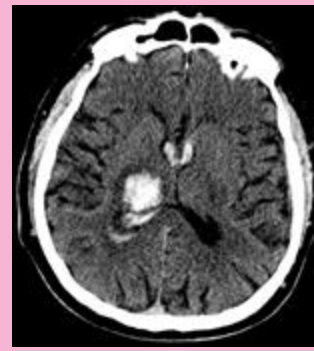
abc

U = U

Acute hemorrhagic stroke

Causes

- Hypertension (top row)
- Cerebral amyloid angiopathy (middle row)
- Vascular malformations (bottom row)



Acute hemorrhagic stroke

Causes

- Hypertension
- Cerebral amyloid angiopathy
- Vascular malformations
- Brain tumor
- CNS infection
- Hemorrhagic conversion
- Vasculitis
- Venous infarct
- Coagulopathy
- Anticoagulants

Work-Up

- CTA Head/Neck to look for vascular malformation
- MRI Brain with and without contrast to look for brain tumors and evidence of ischemic stroke that transformed

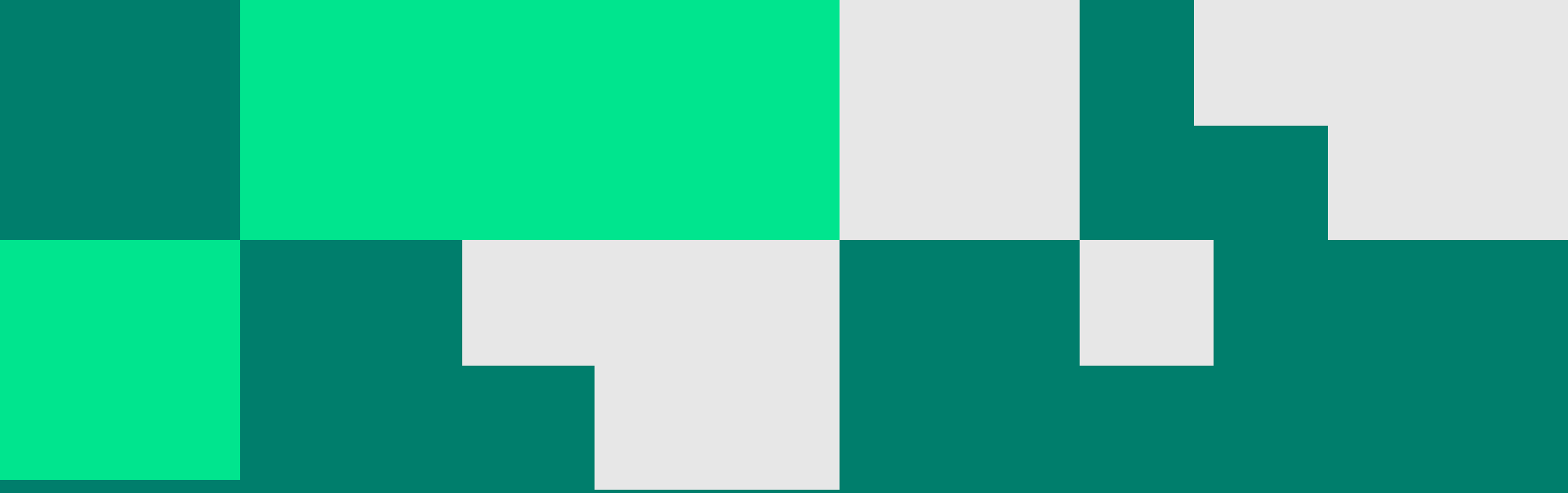
Acute management

- Call stroke neuro, Neuro ICU, and neurosurgery (Code ICH)
- Blood pressure control!! (SBP 140-160)
- Reversal of anticoagulation
- Consideration for surgical intervention if a vascular malformation is found

THE PLAN FOR TODAY

1. Understood the basic components of the stroke alert.
2. Verbalized the rationale behind the major decision pathways for acute ischemic strokes treatments.
3. Described the steps to work-up acute ischemic stroke etiology.
4. Recognized common stroke syndromes.
5. Executed the initial steps of stabilizing a patient with acute hemorrhagic stroke.

We did it!



QUESTIONS? :)



THANK YOU!! :)

My number is 563-581-3691 if you have questions!

