ACUTE STROKE MANAGEMENT

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OBJECTIVES

- Know the appropriate imaging tests to order in the patient with acute stroke.
- Know the evidence for IV-TPA in the management of acute ischemic stroke and the guidelines for its administration.
- Identify the circumstances in which catheter directed clot retrieval is indicated and when it is contraindicated.
- Know the evidence for aspirin therapy in the management of acute ischemic stroke.
- Know the appropriate management of acute stroke in a patient who presents with atrial fibrillation.
- Know the appropriate management of a patient with acute ischemic stroke who presents outside the window for IV-TPA.

COME IN TO SEE A PATIENT AND…

Mrs Smith is a 65 yo female who presented to the ED with back pain and urinary frequency. She was admitted to your service for UTI and pyelonephritis management. She has been doing well and should be discharged tomorrow.

You enter her room this am, she is resting in bed calmly. You wake her and notice she is slurring her speech. Immediately you complete a neurologic exam and notice she is weak on the left. You call the nurse and she said 30 minutes ago she was normal and took her morning medications.

What do you do?

A. Text my cell phone
B. Call a stroke alert and disappear… you don't want to be in the way
C. Call a stroke alert and stay with the patient, after all you known the patient best
D. Order MR brain and start an aspirin

WHAT IS A STROKE?

- SUDDEN onset of focal neurological deficit
  - Brain, retina and spinal cord
- TIA
- How do we make the diagnosis of stroke?

WHO IS THE STROKE TEAM?

- 9 residents
- 4 attendings
- 1 nurse practitioner
- 2 stroke coordinators

- LAB
- CT
- NURSING
- HOUSE SUP
- IR
- TRANSPORT

STROKE ALERT

- What do we want to know?
  - Last time seen normal
  - Focused HPI
  - Medication review
  - Pertinent past medical history

- What are we going to do?
  - Exam (NIHSS)
  - CT BRAIN - noncontrast
  - Acute interventions indicated?

NIHSS: WHAT IS THE POINT

- Stroke severity scale – poor for posterior stroke syndromes
- Just a tool to help guide outcomes and quantify impairment
- Can help monitor clinical decline
- There are 11 sections

"It is a measurement of impairment not a measurement of disability"
(Dr. Harold P Adams Jr)

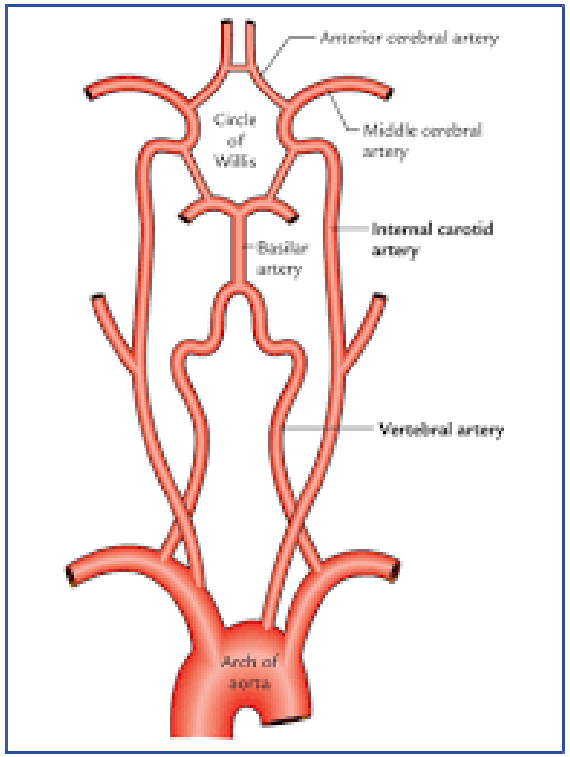
IS THIS A STROKE?

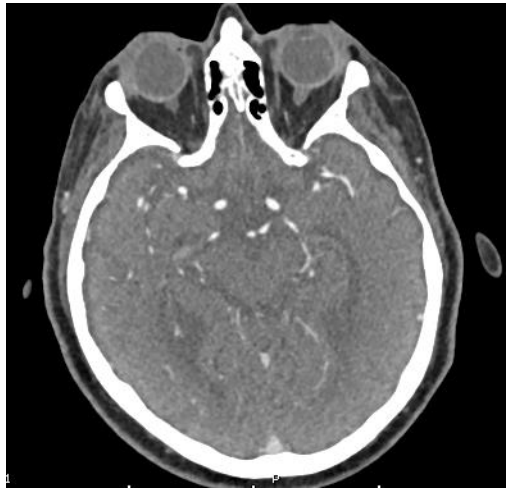
- YES?

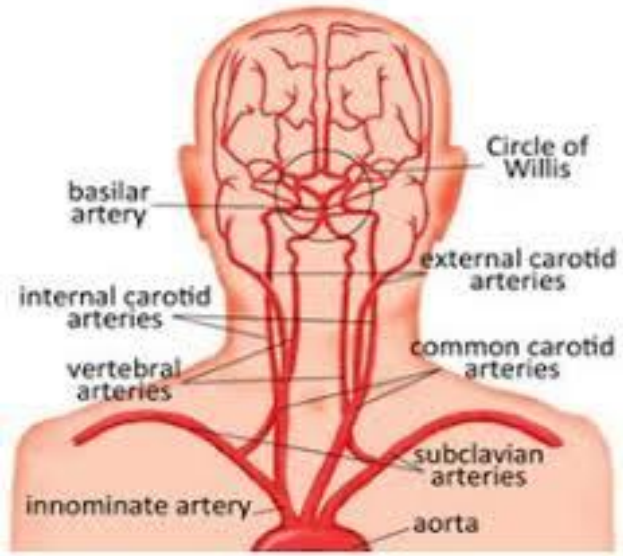
You think you patient is having a stroke after you have completed your neurological exam. You have called the stroke alert as the patient is with in 6 hours of last being seen normal. What is the first diagnostic test you need to obtain for your patient?

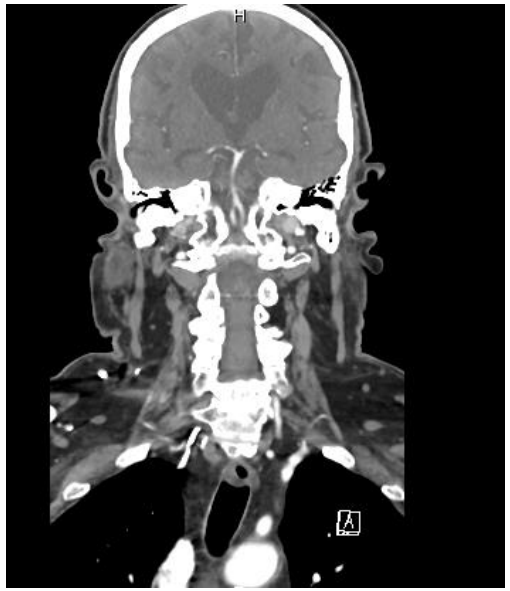
A. MR of the brain, after all it provides a clear diagnosis
B. A non-contrast head CT
C. A contrasted head CT
D. No imaging, we need to start treatment right away!

COMMON STROKE SYNDROMES


Anterior cerebral artery
Circle of Willis
Middle cerebral artery
Internal carotid artery
Basilar artery
Vertebral artery
Arch of aorta



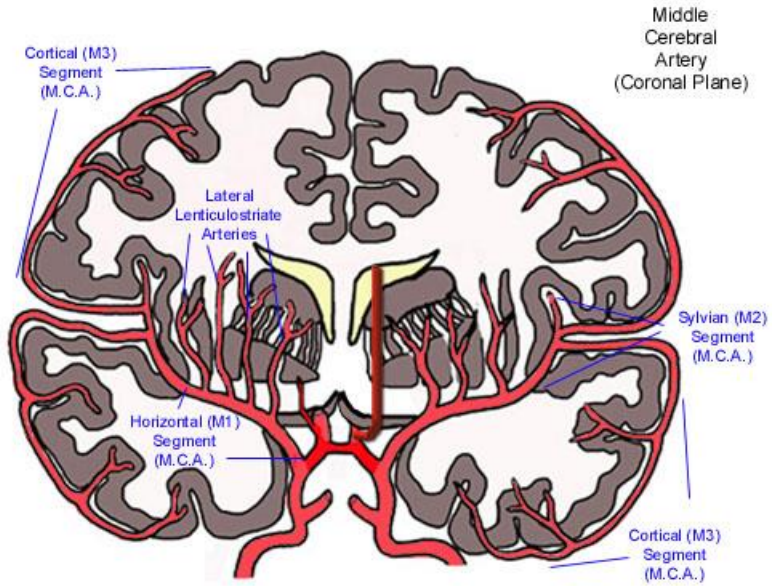

Circle of Willis
basilar artery
external carotid arteries
internal carotid arteries
common carotid arteries
vertebral arteries
subclavian arteries
innominate artery
aorta



LARGE VESSEL SYNDROMES

LMCA stroke

- Decrease mental status
- L gaze preference
- R vision loss
- Aphasia
- R hemiparesis



RMCA stroke

- Decrease mental status
- R gaze preference
- L vision loss
- Neglect
- L hemiparesis

LARGE VESSEL OCCLUSIONS

ACA

- Contralateral leg weakness
- Occasional changes in executive function

PCA

- Contralateral vision loss
  - May be partial
- Sensory change (thalamic)
- Memory change
- Weakness (occasional)
- Language change (L)

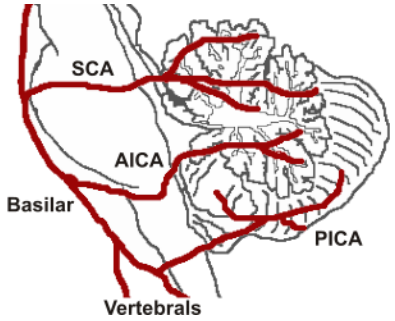
LARGE VESSEL SYNDROMES

Basilar Artery

- CN deficits with contralateral weakness
  - Gaze palsy, facial weakness, dysphagia
- Alternating hemiparesis and posturing
- *Locked – In- Syndrome*
- Acute changes in LOC
  - Obtunded, comatose
- Myoclonic jerks (may be confused with status)

SCA or AICA

- Nausea and vomiting
- Vertigo
- Ataxia
  - Trunk
  - limb

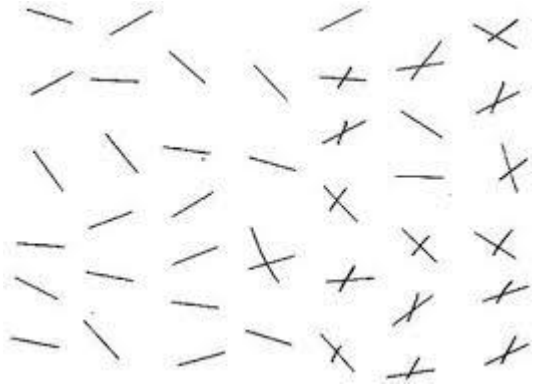


PICA

- Ipsilateral limb ataxia
- Ipsilateral FACIAL sensory loss to pain and temp
- Contralateral BODY sensory loss to pain and temp
- Hoarseness

Wallenberg syndrome

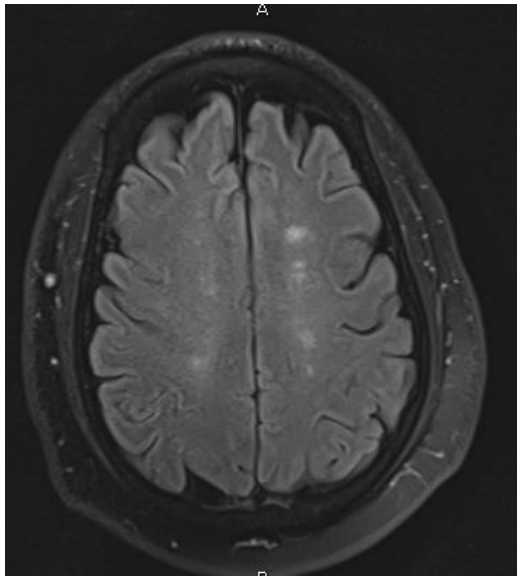
WHAT DOES A LVO STROKE LOOK LIKE?

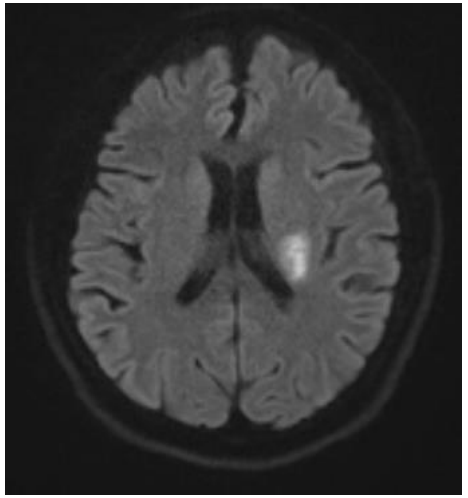


SMALL VESSEL STROKE

- Pure motor
  - Face, arm and leg involvement
- Pure sensory
  - Face, arm and leg involvement
- Sensorimotor
  - Face, arm and leg numbness and weakness

- These syndromes do NOT have cortical symptoms





MRS SMITH

You finish your exam and find that Mrs Smith is sleepy, slurring her speech and only looking to the R. She is not moving her left side much but states she feels fine and denies any symptoms. Her NIHSS is 18. Her non-contrast head CT is normal. What stroke syndrome do you think Mrs Smith is having?

A. A large vessel occlusion, as she has cortical symptoms, L MCA
B. A large vessel occlusion as she has cortical symptoms, R MCA
C. A small vessel syndrome as she has known hypertension and she smokes
D. She has a UTI and this is probably delirium as her head CT is normal

MRS SMITH

Mrs Smith vital signs: HR 103 BP 170/68 RR 15 Pulse Ox is 95% on RA

What is your next step for the treatment of Mrs Smith?

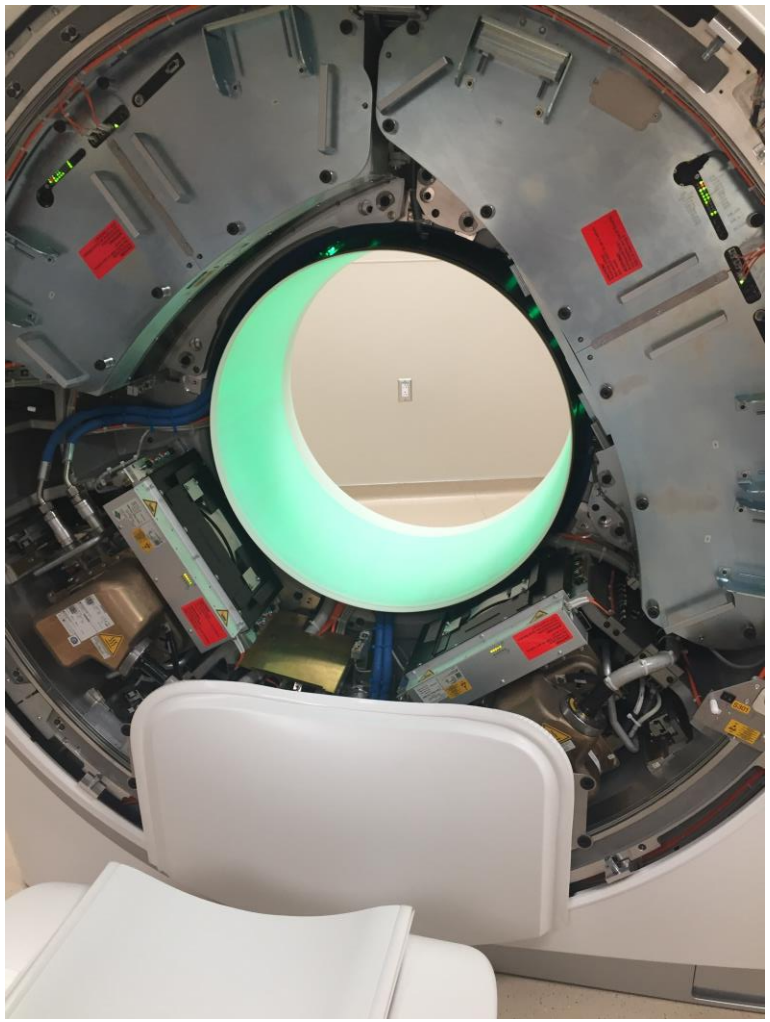
A. Start her on Aspirin therapy
B. Consider and deliver IV Alteplase
C. Thrombectomy
D. MR brain
E. Carotid doppler US STAT!

ACUTE MANAGEMENT OF ISCHEMIC STROKE

- What are out treatment options?

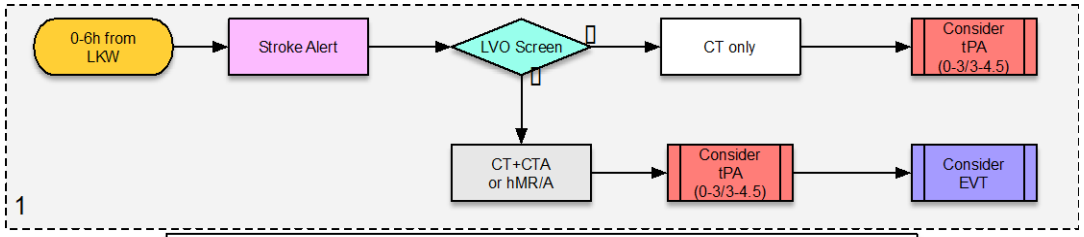
Alteplase (tPA)

Endovascular embolectomy



DIAGNOSTICS – WHAT DO WE ORDER?!?

0-6 hours



LVO Screen

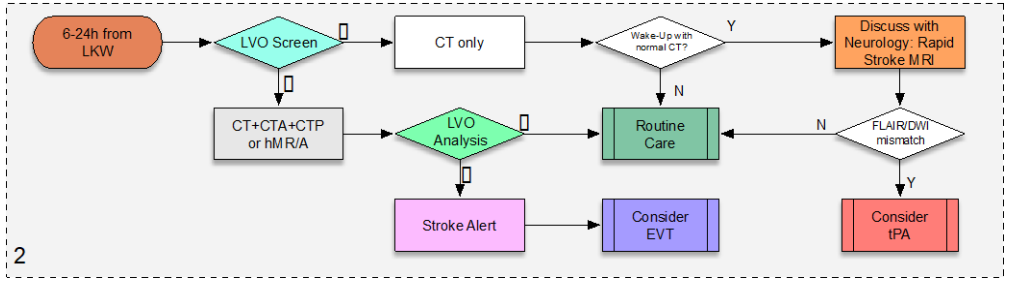
- NIHSS ≥ 6

OR

- VAN ✓: Arm weakness AND (Vision change OR Aphasia OR Neglect)

(All patient baselines should be at most mild disability or independence — mRS ≤ 2)

6 and beyond



LVO Screen

- NIHSS ≥ 6

OR

- VAN ✓: Arm weakness AND (Vision change OR Aphasia OR Neglect)

(All patient baselines should be at most mild disability or independence — mRS ≤ 2)

LVO Analysis

- VIZ.AI ✓

OR

- ASPECTS > 6

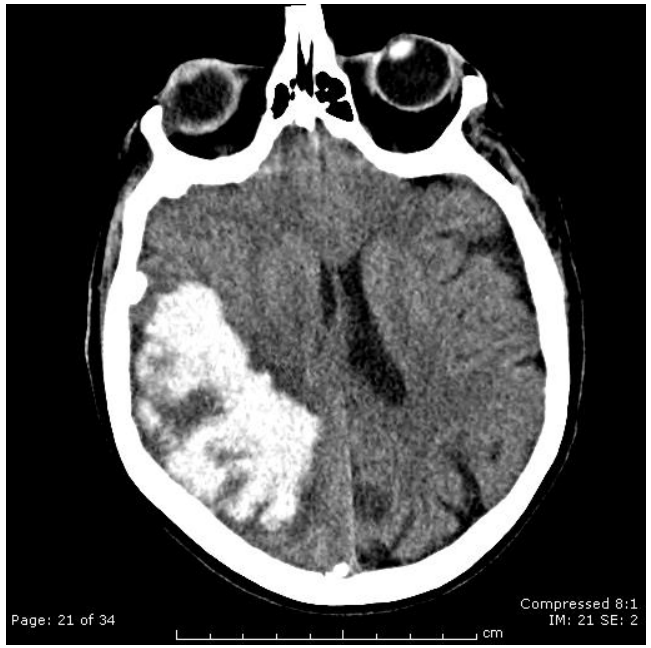
AND

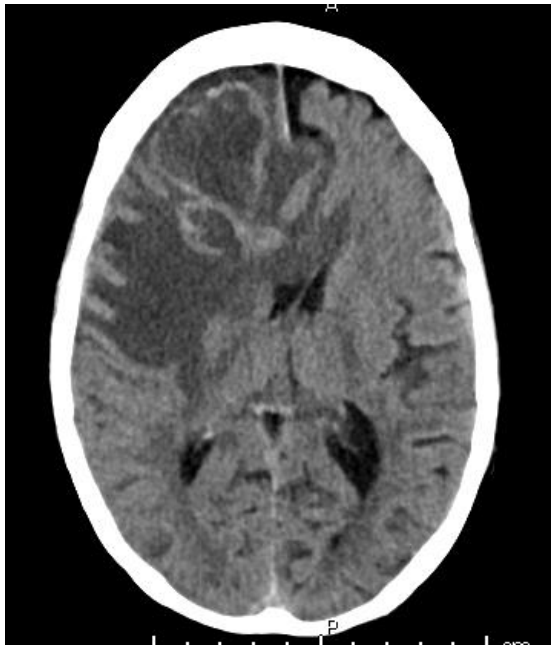
- Intracranial CTA occlusion

OR

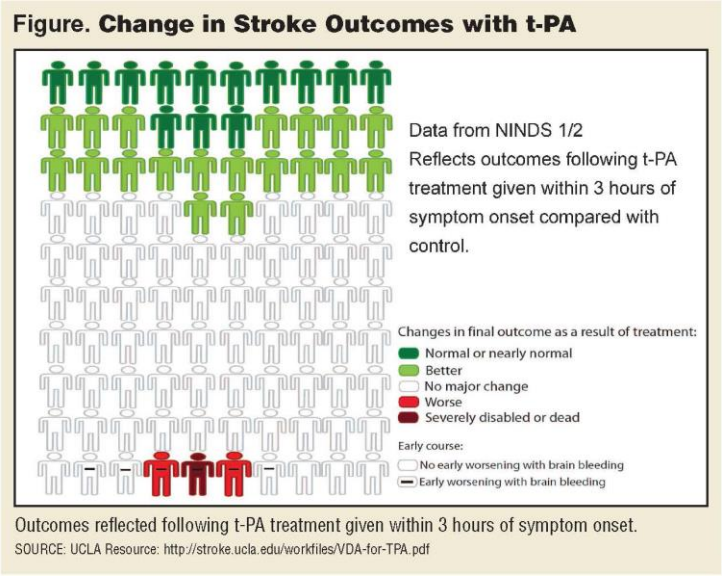
- Radiology read normal/mild CT changes

WHAT ARE WE LOOKING FOR?





ALTEPLASE HISTORY



- 1995 – NINDS (0-3 hours)
  - 30% more likely to have minimal or NO disability
- Best if given within 90 minutes from symptom onset
  - 3x more likely to recovery
- 1998 FAST developed in UK
- 2008 – ECASS III
  - TPA window increased to 4.5 hours for some

INDICATIONS FOR TPA

Diagnosis of ischemic stroke causing measurable neurological deficit

Onset of symptoms <4.5 hours before beginning treatment

Aged ≥18 years

Normal head CT scan

Dose 0.9 mg/kg MAX dose of 90mg

<u>Timeframes</u>

3 hour window

4.5 hour window

(AHA/ASA Guidelines, Guidelines for the Early Management of Patients With Acute Ischemic Stroke

ALTEPLASE

Indications

- **3 – 4.5 hour timeframe … but**
  - <80 yo
  - No hx of diabetes AND prior stroke
  - NIHSS <25
  - No anticoagulation (despite INR)
  - No ischemic changes on CT >1/3 MCA territory
- Disabling stroke symptom
  EVEN IF MILD
- Glucose >50 (okay to normalize first) <400
- BP <185/110 (to start)
- Okay if on antiplatelets, even dual antiplatelets
- ESRD on HD – okay if PTT is normal
  - *may be higher risk with elevated PTT*

Contraindications

- Severe head trauma in the past 3 months
- Presenting with s/sx most consistent with a SAH
- Platelets <100,000
- INR >1.7, aPTT >40 or PT> 15
- Therapeutic Lovenox in last 24 hrs
- DOAC use in last 48 hours or abnormal coags
- If etiology is infective endocarditis
- Aortic arch dissection
- May be harmful:
  - Ischemic stroke in the past 3 months
  - Intracranial/spinal in the past 3 months
  - History of prior intracranial hemorrhage
  - Structural GI malignancy, recent GIB (21 days)
  - Inta-axial intracranial neoplasm

MRS SMITH

Alteplase is being administered based on the indications in the guidelines after verbal discussion/consent with her husband. Her vital signs have remained unchanged. Suddenly she starts complaining of a headache. What is your next step in the care for your patient?

A. Finish rounding on your other patients, you have more than one patient today.
B. Pause the tPA and order a STAT repeat non- contrast CT brain.
C. Headache is common side effect of tPA, reassure the patient.
D. Prescribe Percocet for pain.

ADVERSE EVENTS TO TPA… OH NO!

Hemorrhage

Table 8. Management of Symptomatic Intracranial Bleeding Occurring Within 24 Hours After Administration of IV Alteplase for Treatment of AIS

Class IIb, LOE C-EO
Stop alteplase infusion
CBC, PT (INR), aPTT, fibrinogen level, and type and cross-match
Emergent nonenhanced head CT
Cryoprecipitate (includes factor VIII): 10 U infused over 10–30 min (onset in 1 h, peaks in 12 h); administer additional dose for fibrinogen level of <200 mg/dL
Tranexamic acid 1000 mg IV infused over 10 min OR ε-aminocaproic acid 4–5 g over 1 h, followed by 1 g IV until bleeding is controlled (peak onset in 3 h)
Hematology and neurosurgery consultations
Supportive therapy, including BP management, ICP, CPP, MAP, temperature, and glucose control

Angioedema

Table 9. Management of Orolingual Angioedema Associated With IV Alteplase Administration for AIS

Class IIb, LOE C-EO
Maintain airway
Endotracheal intubation may not be necessary if edema is limited to anterior tongue and lips.
Edema involving larynx, palate, floor of mouth, or oropharynx with rapid progression (within 30 min) poses higher risk of requiring intubation.
Awake fiberoptic intubation is optimal. Nasal-tracheal intubation may be required but poses risk of epistaxis post-IV alteplase. Cricothyroidotomy is rarely needed and also problematic after IV alteplase.
Discontinue IV alteplase infusion and hold ACEIs
Administer IV methylprednisolone 125 mg
Administer IV diphenhydramine 50 mg
Administer ranitidine 50 mg IV or famotidine 20 mg IV
If there is further increase in angioedema, administer epinephrine (0.1%) 0.3 mL subcutaneously or by nebulizer 0.5 mL
Icatibant, a selective bradykinin B_2 receptor antagonist, 3 mL (30 mg) subcutaneously in abdominal area; additional injection of 30 mg may be administered at intervals of 6 h not to exceed total of 3 injections in 24 h; and plasma-derived C1 esterase inhibitor (20 IU/kg) has been successfully used in hereditary angioedema and ACEI-related angioedema
Supportive care

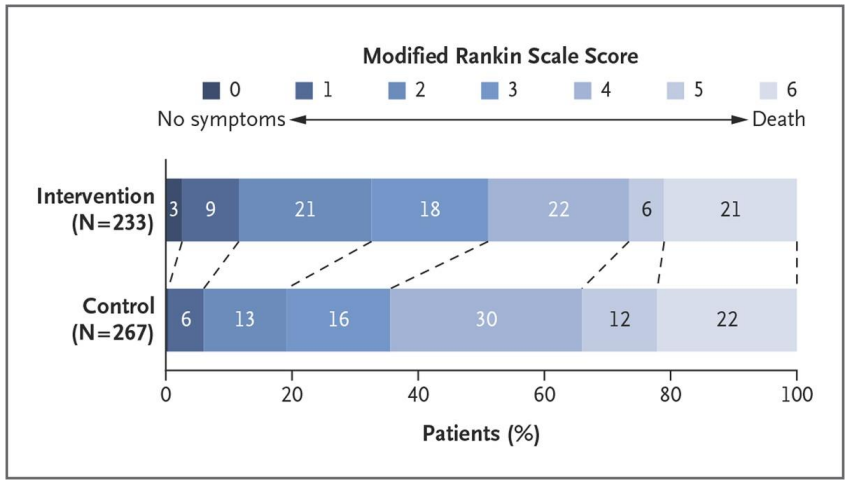
MRS SMITH

You review the non-contrast head CT and it remains normal. Her headache is gone by the time the CT is done. You have resumed the tPA. What is your next diagnostic test?

A. MR of the brain
B. MR angiogram of the brain
C. Carotid Ultrasound and transcranial doppler
D. CT angiogram of the brain and neck

ENDOVASCULAR TREATMENT

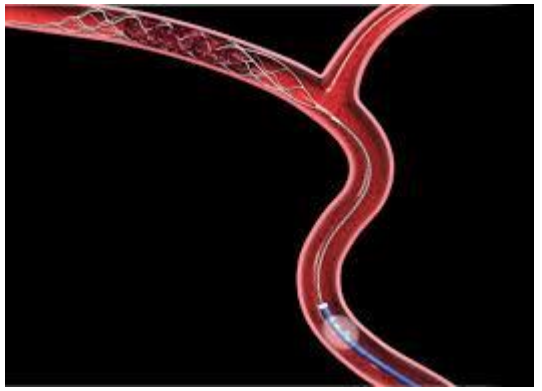
EVT HISTORY



- 2005 MERCI
- 2012 TREVO 2 , DEFUSE 2
- 2013 IMS III – stopped early due to futility

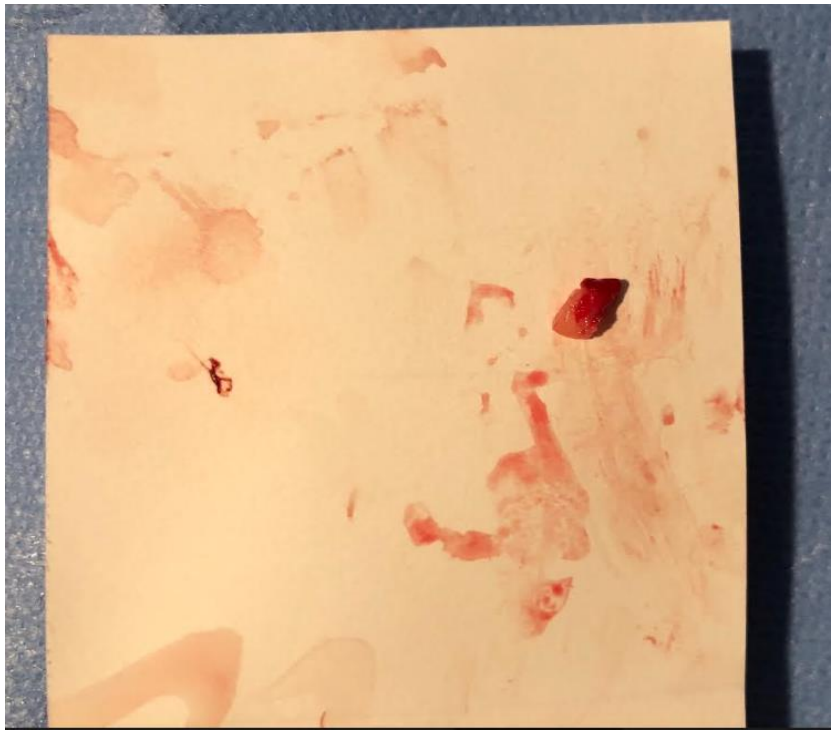
- 2015 Guidelines updated for stent retrievers to be used for mechanical clot removal
  - Mr CLEAN (2015) – showed benefit for 6 hours after last seen normal
  - ESCAPE (2015)
  - SWIFT PRIME (2015)
  - EXTEND IA (2015)
  - REVASCAT (2015)

We have now know benefit for EVT up to ~8 hours from onset of stroke



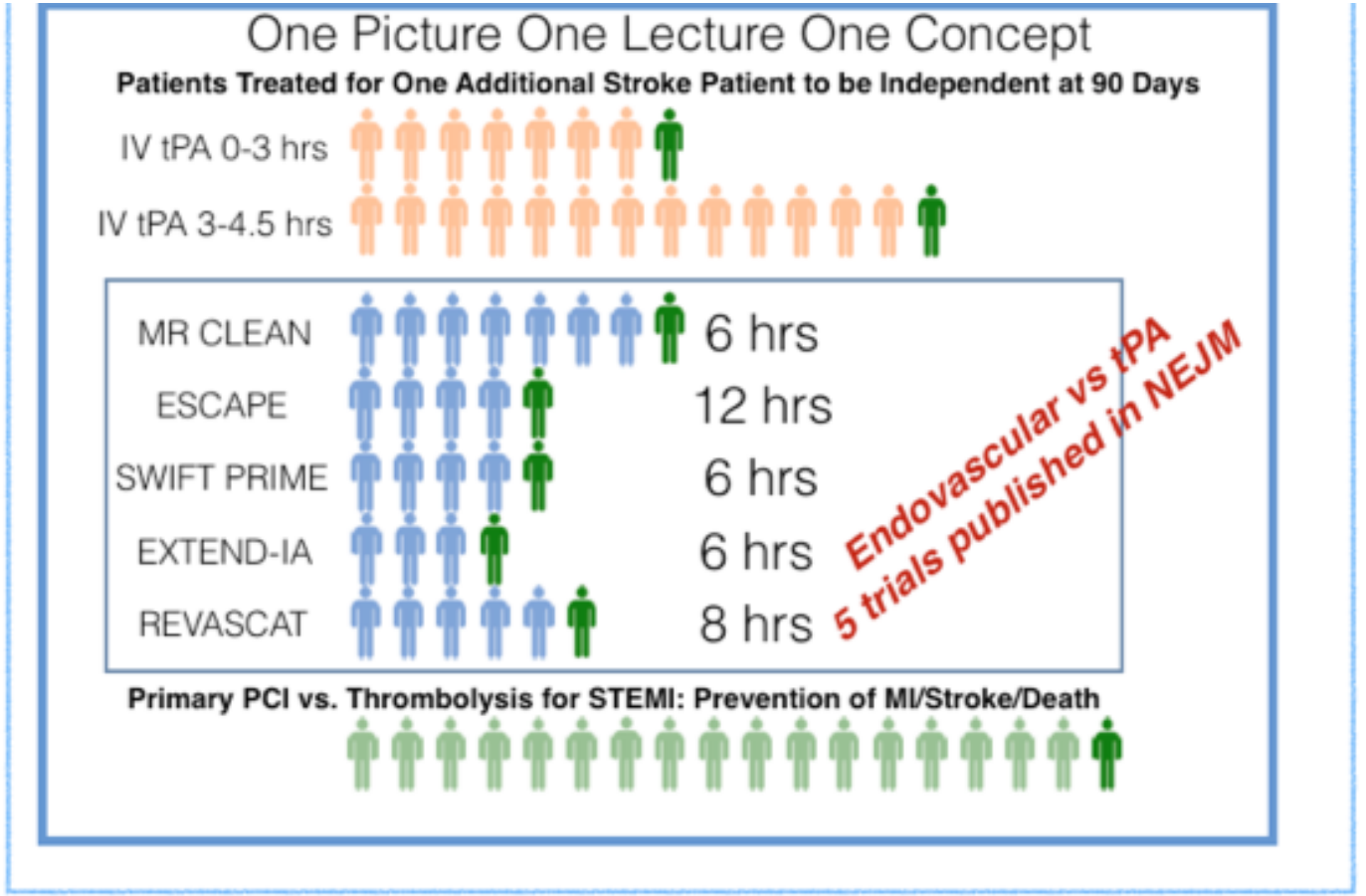
CLINICAL TRIALS

- We have known that thrombectomy with in 6 hours of onset with anterior LVO strokes was beneficial … but what about after that?



- DAWN (2017)
  - Treatment 6 hours to 24 hours from LKW
  - M1 or intracranial ICA occlusion
  - Number needed to treat 2-3
  - Need mismatch between infarct volume and clinical severity
  - Stopped early secondary to benefit

- DEFUSE 3 (2018)
  - Treatment 6-16 hours post LKW
  - Anterior LVO
  - Perfusion with mismatch

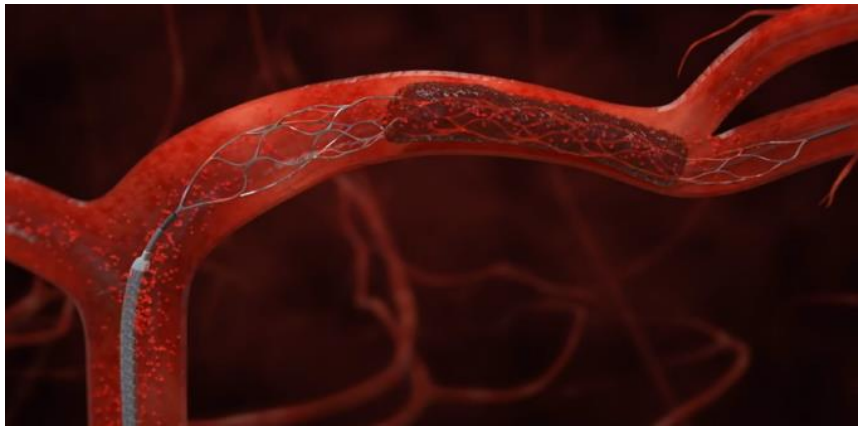

One Picture One Lecture One Concept
Patients Treated for One Additional Stroke Patient to be Independent at 90 Days
IV tPA 0-3 hrs
IV tPA 3-4.5 hrs
MR CLEAN
6 hrs
ESCAPE
12 hrs
SWIFT PRIME
6 hrs
EXTEND-IA
6 hrs
REVASCAT
8 hrs
Endovascular vs tPA
5 trials published in NEJM
Primary PCI vs. Thrombolysis for STEMI: Prevention of MI/Stroke/Death

ENDOVASCULAR TREATMENT:

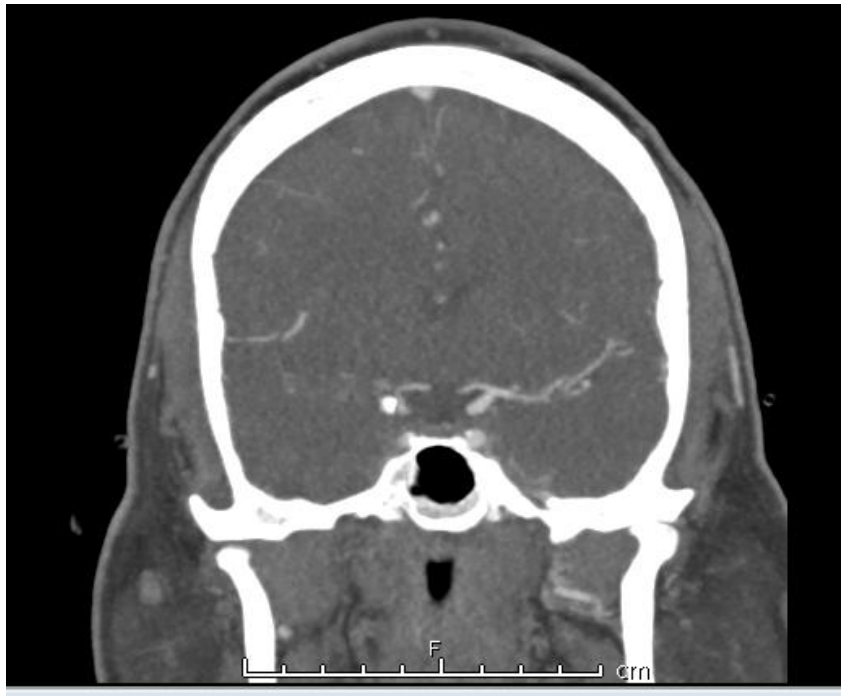
- Who
  - Large artery occlusion
  - Functional good baseline
- When
  - Up to 24 hours in patients who meet criteria – as soon as possible

- Why
  - Reduce stroke volume – save the penumbra
  - Decrease complications from large stroke
  - Improve patient outcome
  - Twice as likely to have a good outcome
  - Decreased disability
    - About 44% reduction in disability rate

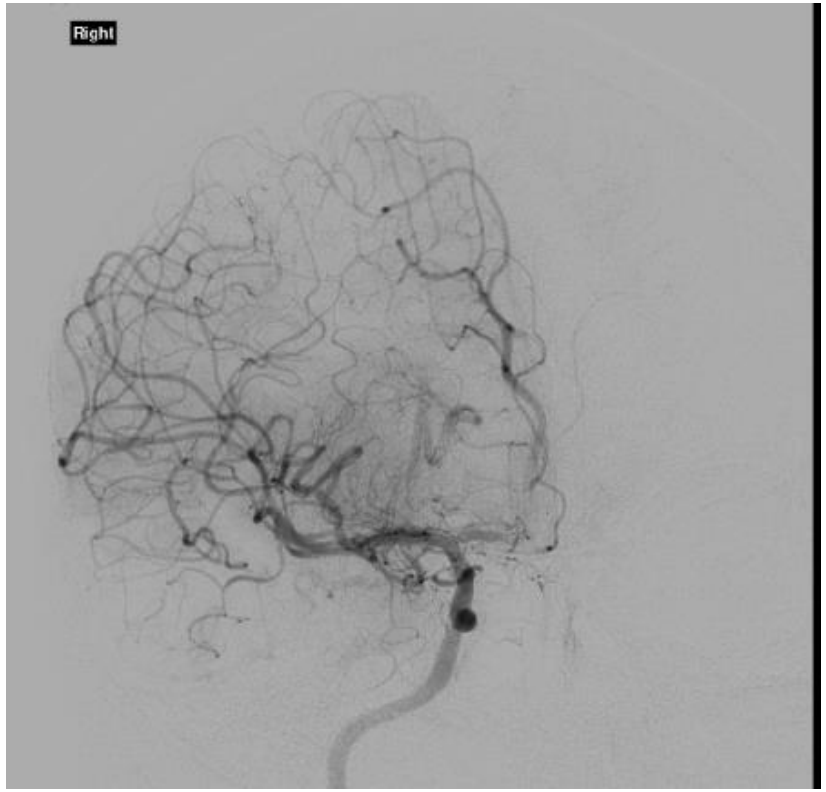
MRS SMITH



- She is taken emergently to IR for a thrombectomy

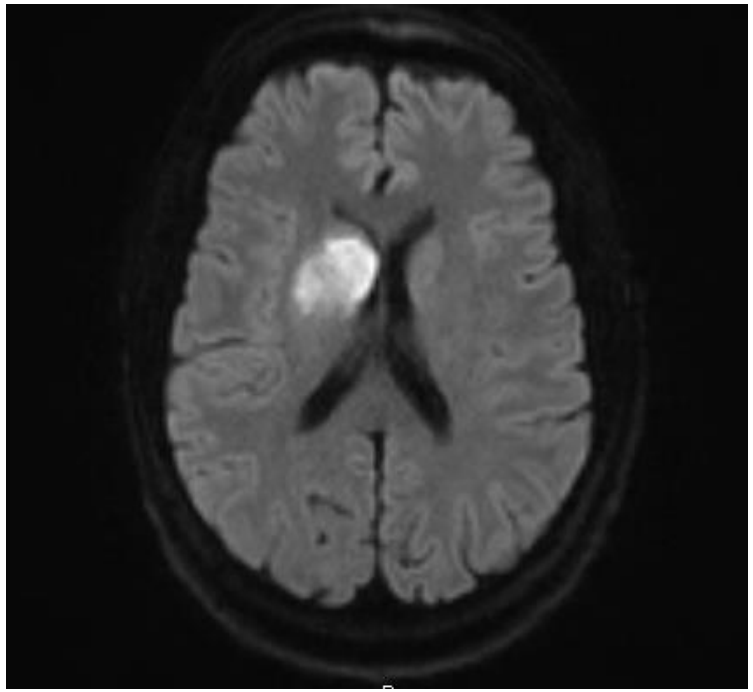


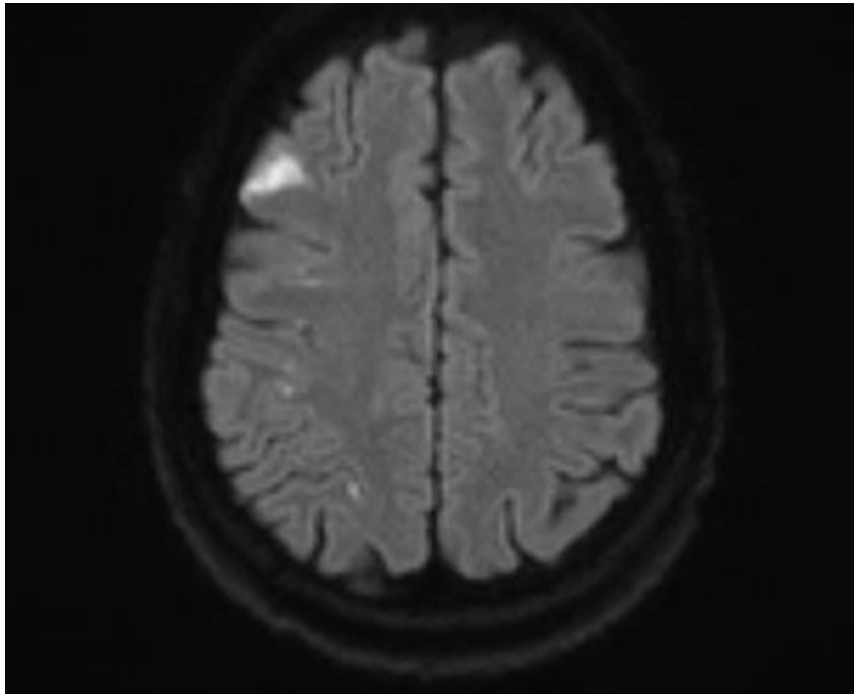

Right


Right

NSICU

- Post tPA
- Post IR
- Hemodynamic instability
- Hemorrhagic stroke






OH YEAH!!!

ROUTINE MANAGEMENT OF ISCHEMIC STROKE

- TIA

  TREAT AS A STROKE

  OOU if asymptomatic

- Stroke work up
  - Did you have a stroke?
  - What caused your stroke?
  - What are your risk factors?
  - What are we doing about it?
  - What is the next step?

ROUTINE STROKE

- Admit to neuro telemetry
  - Screening for afib
- OOU if ASYMPTOMATIC
- NPO INCLUDING medications for nursing or SLP eval.
  - Meds either IV/PR or via DT

DIAGNOSTIC TESTING

- Goal is to identify etiology as well as for risks for stroke
- Imaging
  - MR brain WITHOUT contrast
  - CT angiogram (MRA only if contraindication to CTA)
    - Last resort carotid doppler
  - Echocardiogram
- Labs
  - A1C
  - Lipid profile
- Tele monitoring
- Use our order sets!

FIRST LINE MEDICATIONS

- ASA 325 mg or 300 mg PR – started by the 2nd midnight
  - ASA 81mg daily UNCOATED at discharge unless otherwise specified in our note
  - Plavix as second option
- Lovenox or heparin for DVT prophy – started by the 2nd midnight
- Statin therapy – Atorvastatin 40 mg or 80 mg, can then be dose adjusted. Start when oral route cleared or DT placed.
- BP meds – acute BP goal <200/100 (unless given IV tPA or IPH)
  - Depending on imaging, will start to normalize BP
  - Long term blood pressure management

CLASSIFICATION OF STROKE

Toast Criteria

Cardioembolic
Large Artery Occlusive
Small Vessel Occlusive
Other
Cryptogenic

MRS SMITH

- Well you have done very well with providing the most comprehensive stroke care to Mrs Smith however the nurse calls you. She does not look good. Her heart rate is 138 and seems to be irregular. Blood pressure is stable. You get an ECG and yep… just as your suspected… she is in atrial fibrillation.

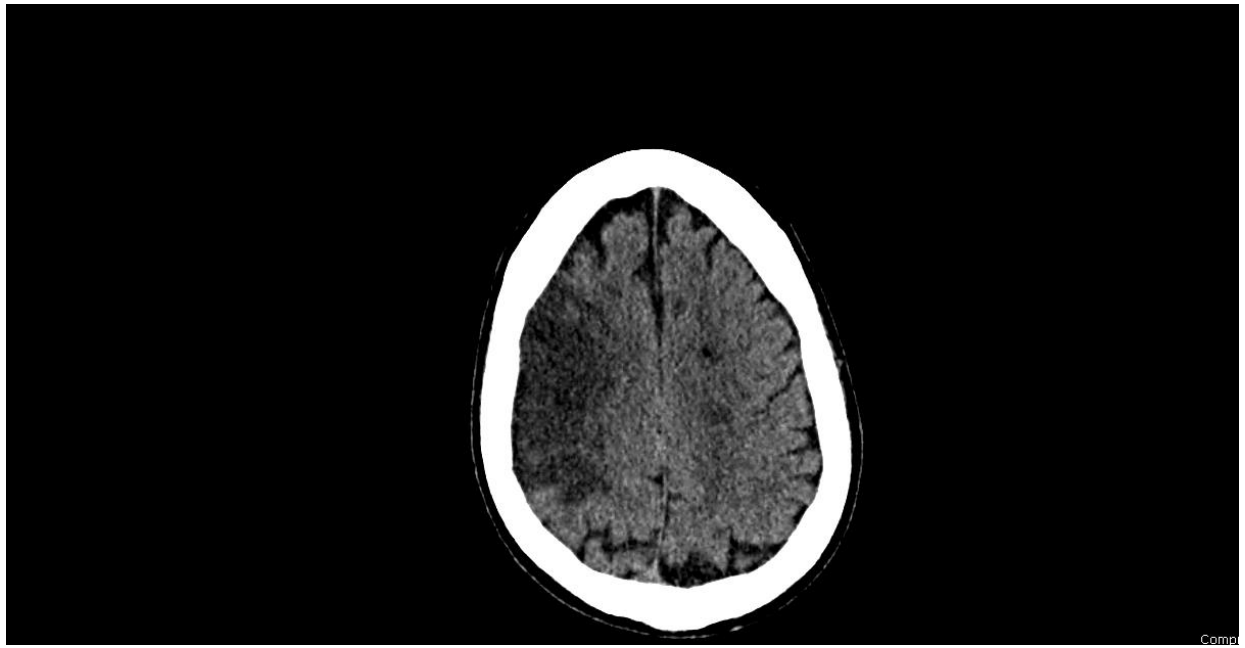
- What is your next step?
  A. Start lovenox 1kg/mg BID
  B. Start heparin gtts
  C. Ensure you are out of the 24 hour post tPA window and start aspirin
  D. Start Eliquis 5 mg BID

CARDIOEMBOLIC STROKE

- Atrial fibrillation
  - ASA for ~2weeks, then transition to oral anticoagulation
    - May be longer (or shorter) depending on imaging
  - If have acute LA/LV thrombus – heparin gtts **without** bolus
    - Again, may depend on risk based on imaging
  - Rate management for hemodynamic stability

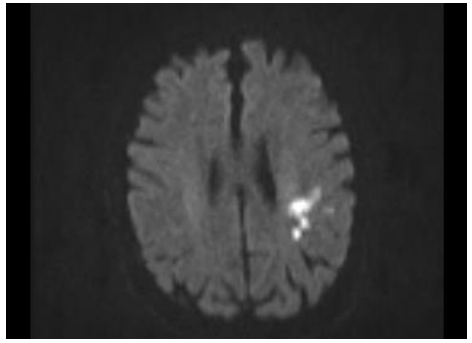
- CHADS and CHADSVASC
  - But once have stroke – need anticoagulation

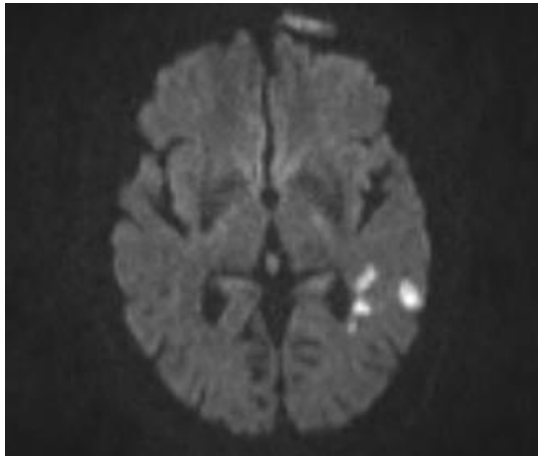
- Endocarditis, arch atheroma, cardiomyopathy

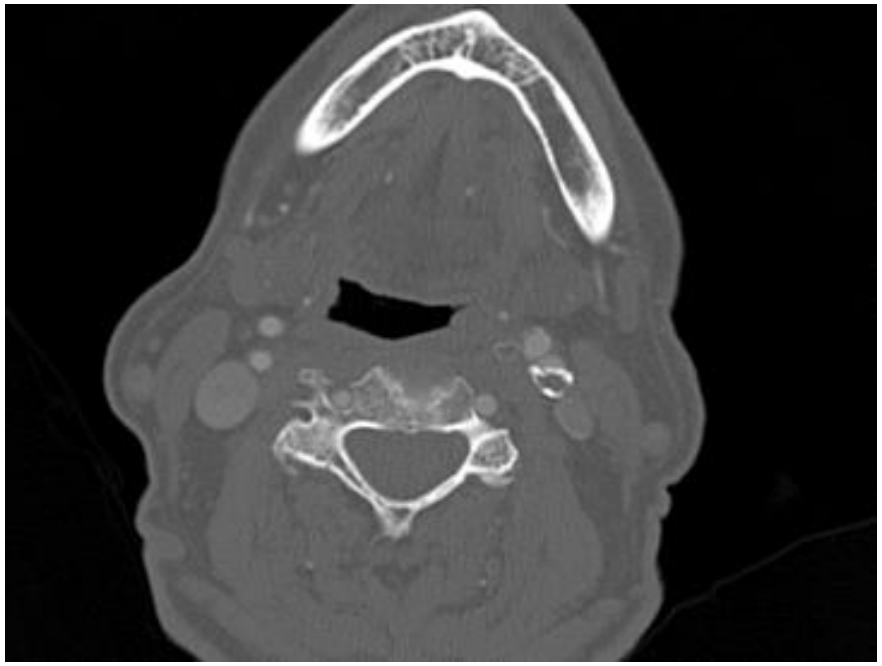


LARGE ARTERY OCCLUSION

- Carotid artery disease
  - Revascularization? Enrolling in CREST 2
    - Now is the time – within 2 weeks, depends on stroke and risks
    - Moderate to severe stenosis
    - No intervention if occluded.
- Intracranial stenosis
  - SAMMPRIS
    - MAXIMAL medical management
      - ASA 325mg +plavix for 3 months
      - High intensity statin
      - BP management
      - Lifestyle

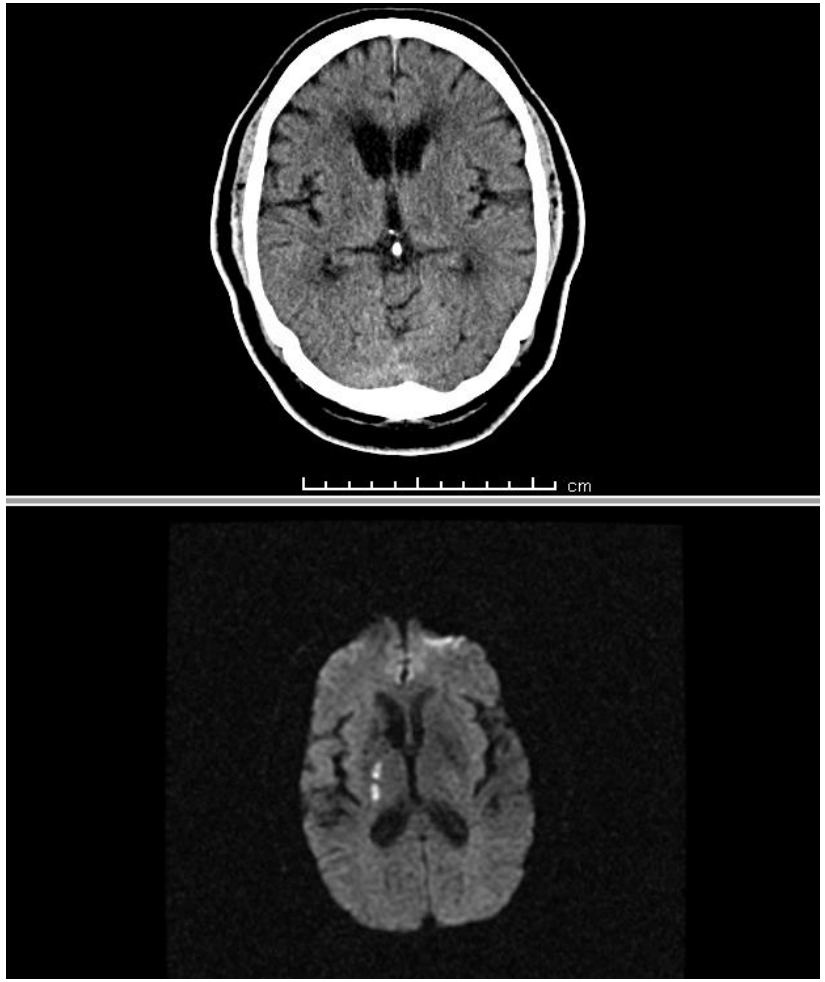






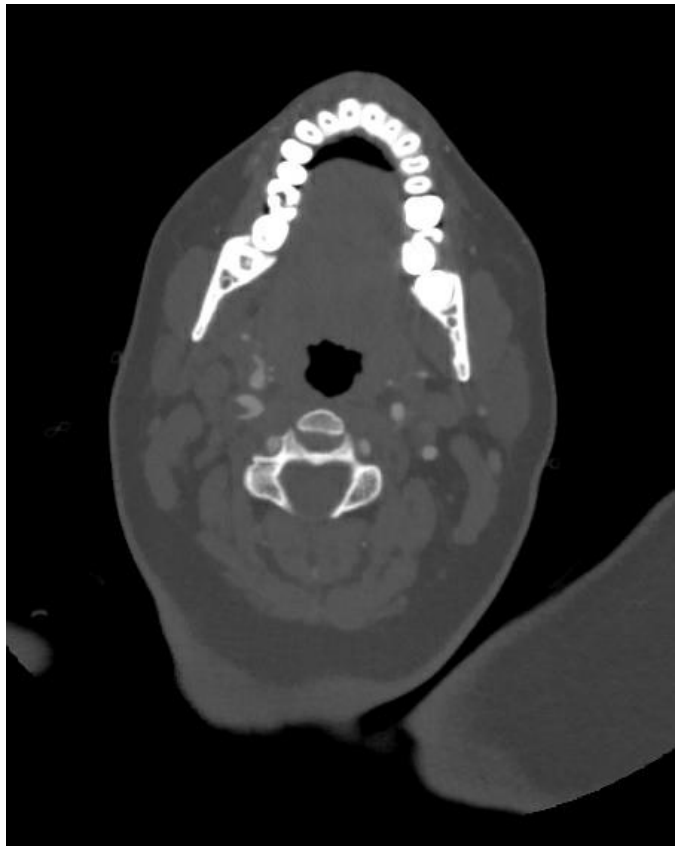
SMALL VESSEL

- Hypertension
- Diabetes
- Smoking



OTHER

- Trauma – dissection management
- Hypercoagulable states



CRYPTOGENIC

- TEE and long term cardiac monitoring.
- Hypercoag panel ? – consideration
- Angiogram

Figure 2: Reveal LINQ insertable cardiac monitor.

UNDERSTANDING THE PATIENTS PERSONAL RISKS FOR STROKE

Sleep apnea

Hypertension

Heavy alcohol use

Drug use

Age

Family history

Obesity

STROKE

Coronary Artery Disease

Smoking

High Cholesterol

Peripheral vascular disease

Inactivity

Prior stroke

Atrial Fibrillation

Diabetes

ASSESSING THE DAMAGE

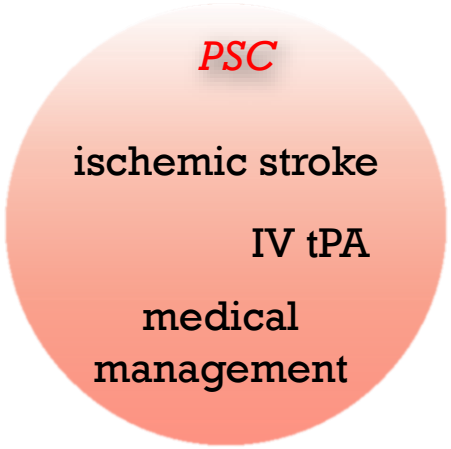
- Physical therapy
- Occupational therapy
- Speech therapy
- Music therapy
- Pet therapy
- Acute rehab
- SNF

FOLLOW UP PLAN

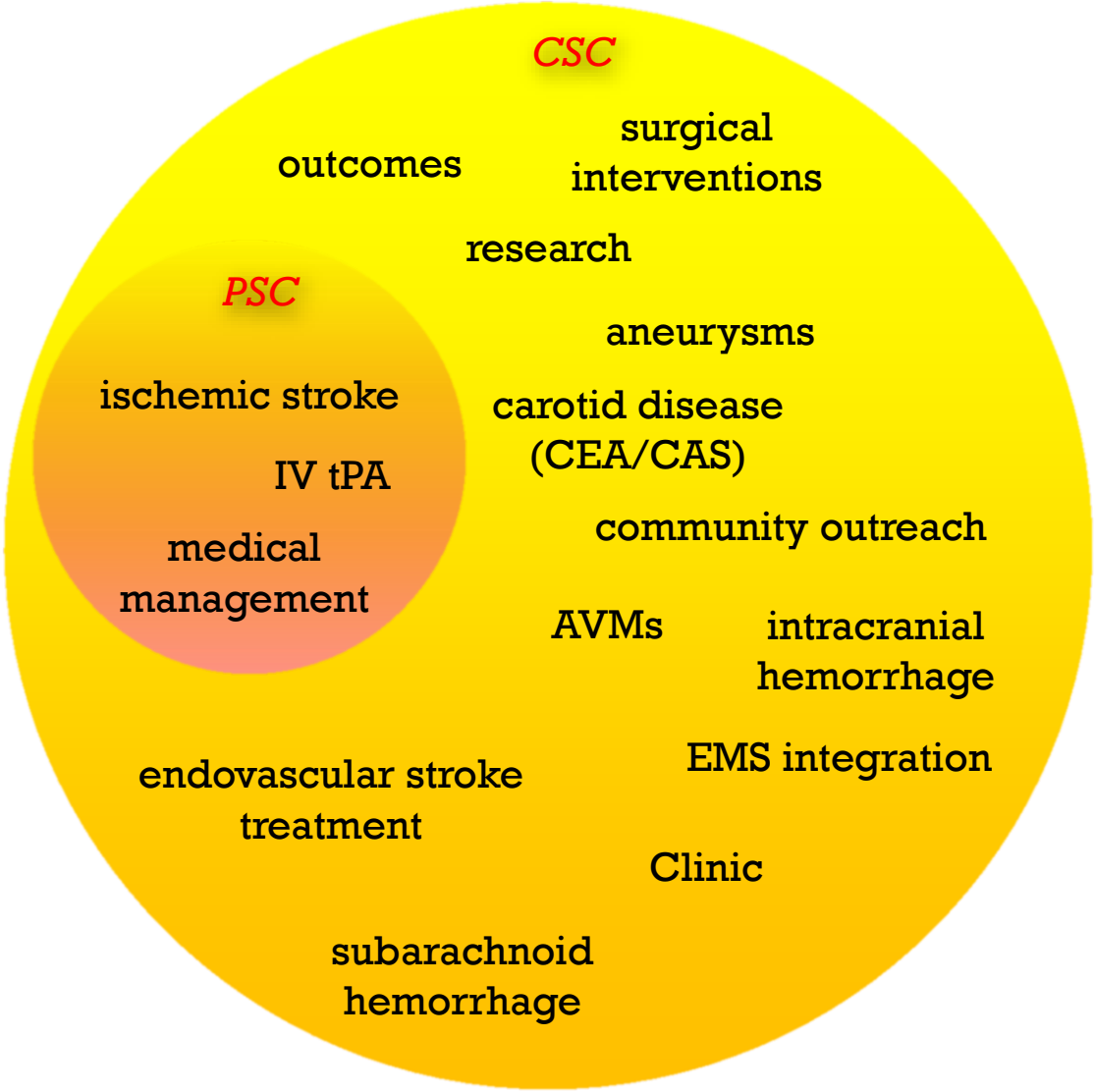
- Typically in our clinic in 2-3 months – outcome measurements evaluated.
- Need a PCP!
- Sleep studies
- Outpatient cardiac evaluations
- Dispo medications –
  - Antiplatelet (or OAC)
  - Statin
  - BP medications
  - DM management

Stroke Nurse Navigator – Cassandra Wolf

PRIMARY VS COMPREHENSIVE STROKE CENTERS



PRIMARY VS COMPREHENSIVE STROKE CENTERS

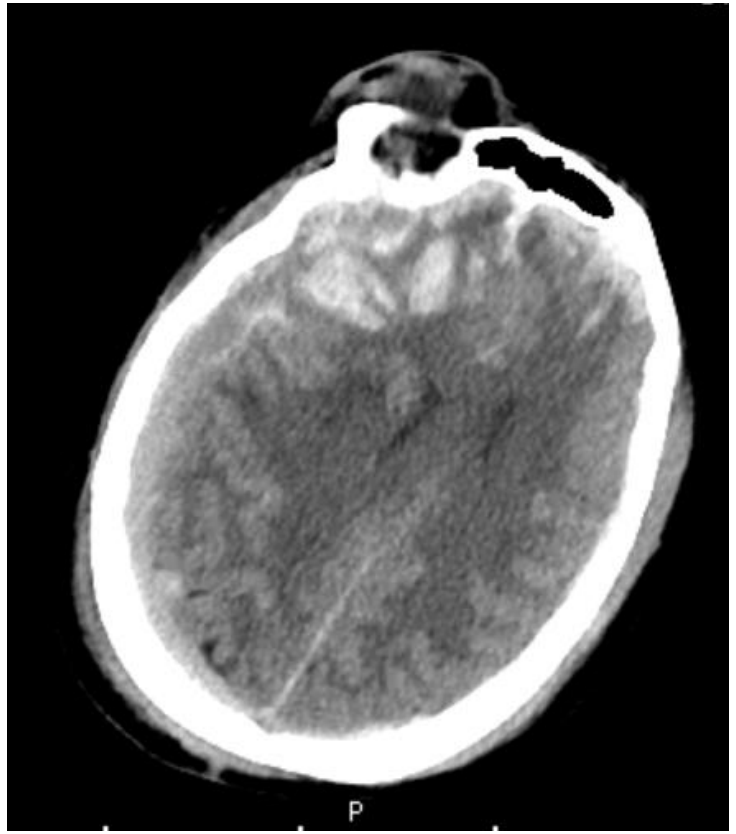


ACUTE MANAGEMENT OF HEMORRHAGIC STROKE

- Well we have a bleed… now what?

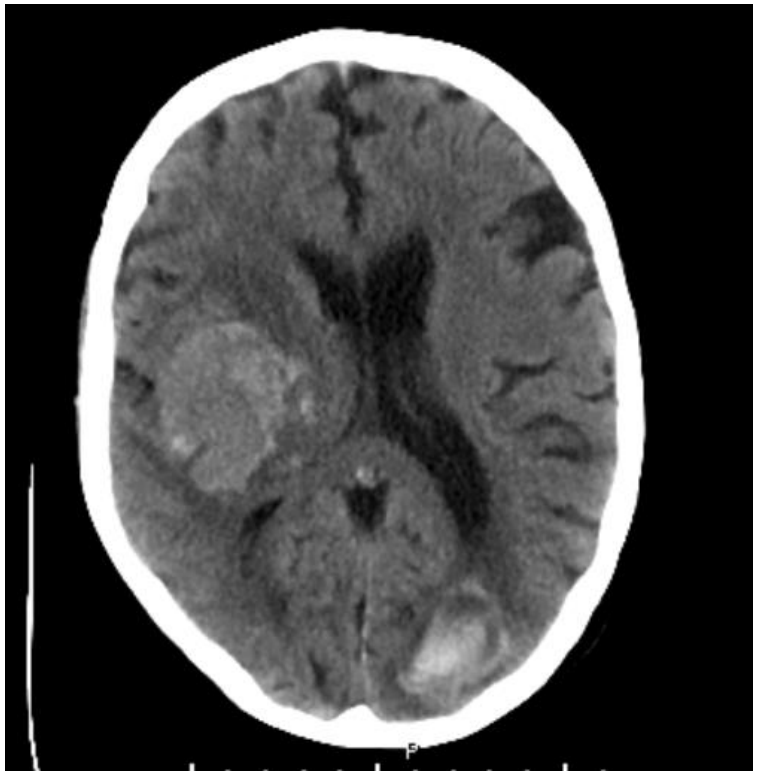
TYPES OF CEREBRAL HEMORRHAGES

- SAH
- SDH
- IPH
- IVH
- Epidural hematoma



WHAT BLEEDS IN THE BRAIN

- Primary hemorrhage
- Trauma
- Tumor
- Vascular Abnormality
- Cerebral amyloid angiopathy
- Hemorrhagic conversion of an ischemic stroke
- CVST

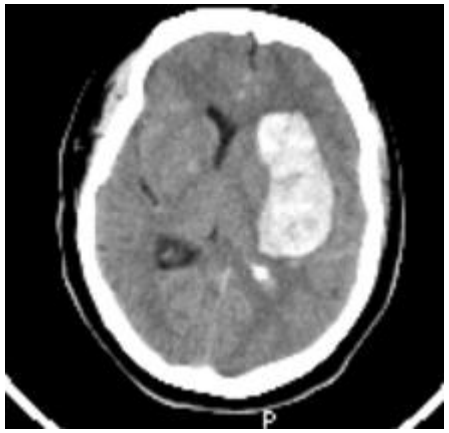


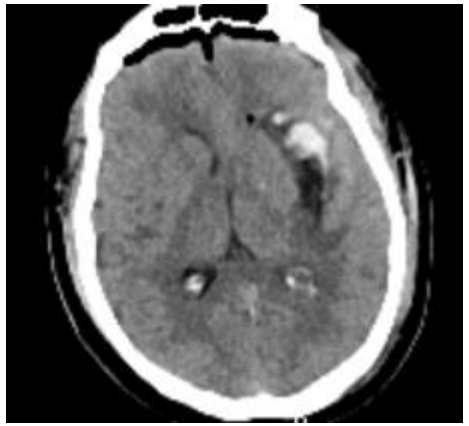
GOALS OF ACUTE HEMORRHAGE MANAGEMENT

- Stop the progression
  - Blood pressure management
    - <140 mmHg systolic
  - Coagulopathy management
    - Reversal?
  - Exam monitoring
    - Intubation
    - ICP elevation
    - Hydrocephalus
  - Stability on CT scans
    - 6hr stability scan
    - CTA
  - ICP management

WHEN TO CALL NEUROSURGERY

- To help with surgical intervention for ICP management
  - Decompression?
  - EVD placement
- SAH – aneurysmal
- Tumor





MRS SMITH

- Now is day of discharge and Mrs Smith does not have any acute rehab needs. She will go home with out patient therapy. They are very pleased with the care provide and you want to make sure your discharge is perfect!

What do you include in your discharge information?

A. Aspirin therapy, including dose with a start date and prescription for anticoagulation
B. High intensity statin therapy to address her hyperlipidemia
C. Blood pressure medications to address her hypertension
D. Smoking cessation information
E. Follow up appointment in 1-2 weeks with neurology
F. A,B, C and D
G. All the above

QUESTIONS

602-839-2586