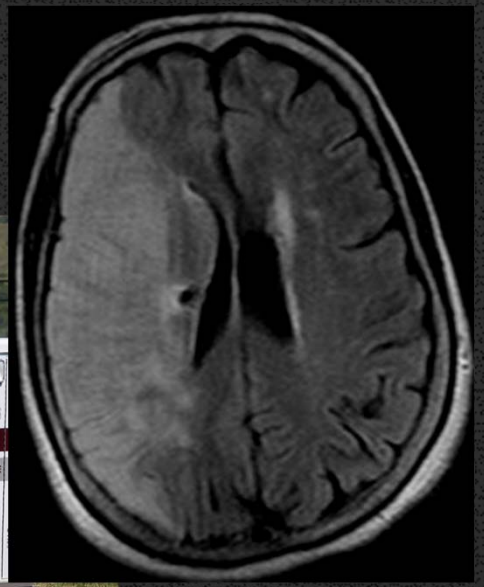
STROKE CASE STUDIES IMPLICATIONS FOR EMS

Orin Eddy, MD, FACEP
ED Stroke Champion
Emergency Department
Kaiser Redwood City
October 29, 2015



Disclosures

- none

Overview

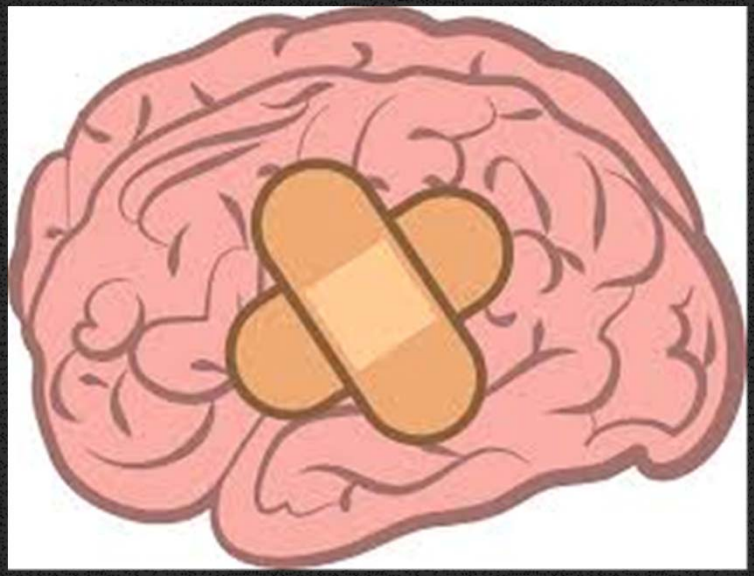
- Discuss current emergency department management of acute stroke, including standard therapy, IV tPA and endovascular treatment
- Review the risks, benefits and alternatives of IV thrombolysis for stroke
- Review cases of stroke

Treatment Options for Stroke

- Standard therapy
- IV tPA
- Endovascular therapy

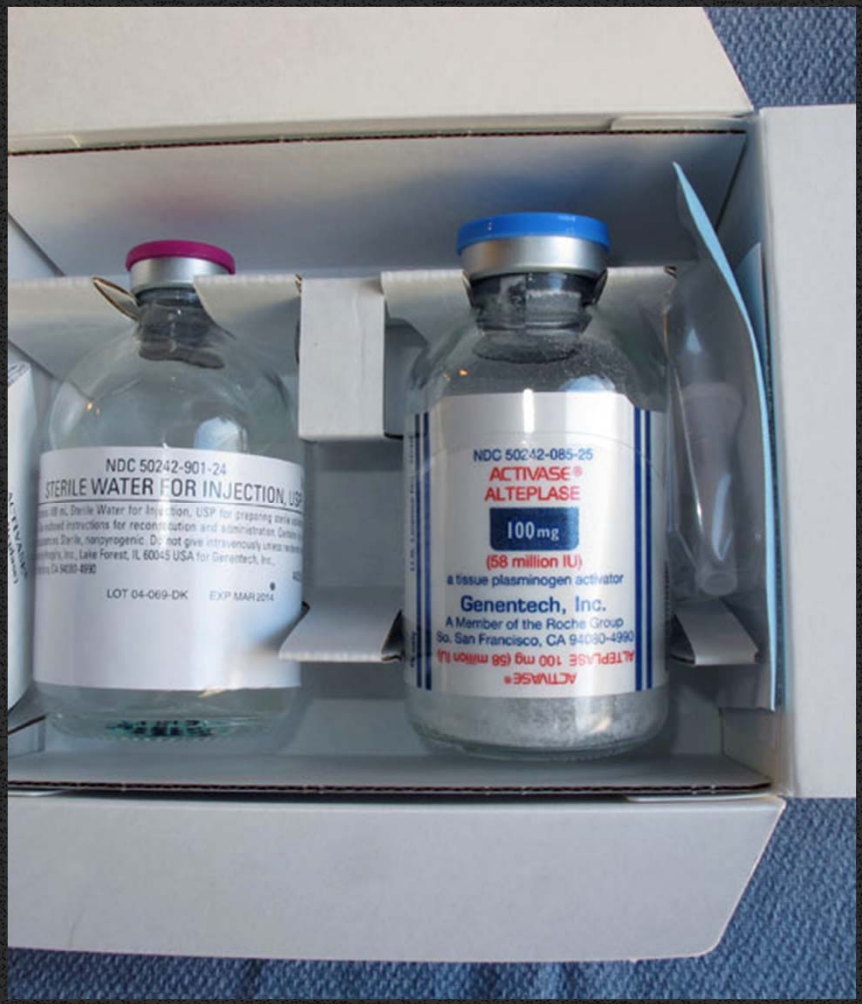
Standard Therapy

- Risk factor modification
- Anticoagulation or antiplatelet therapy
- Physical therapy, occupational therapy, speech therapy
- Aspiration prevention



tPA

- What is it?
- Tissue Plasminogen Activator
- An enzyme which works to breakdown blood clots
- May also be used for pulmonary embolism and myocardial infarction



tPA

- Risks and Benefits

IV tPA

- Risks
  - Increases the risk of intracranial hemorrhage. From the NINDS trial, the risk was increased by 6%, with a NNH=17.
  - Bleeding at other sites
  - Adverse or allergic reaction to medication, angioedema

IV tPA

- Benefits
  - More likely to have better functional outcome. Some patients will benefit, some will see no difference and a few will be worse off.
  - Chance of significant improvement depends on how rapidly the drug can be given after onset of symptoms. For tPA given within 0-3 hours of onset, the NNT=8. For 3-4.5 hours, the NNT=14.

tPA indications

- Age ≥ 18 years
- A significant neurologic deficit
- Non contrast head CT demonstrates no ICH and no new well-established infarct
- Onset within 3 or 4.5 hours

tPA Contraindications 0-3 hours

- CT demonstrates bleed
- Recent intracranial or spinal surgery, head trauma (<3 months)
- Presence of intracranial condition that may increase the risk of bleeding (certain types of tumors)
- Active internal bleeding
- Use of target-specific oral anticoagulant in the last 2 days
- Platelets < 100,000, INR > 1.7, or known bleeding diathesis
- Severe uncontrolled hypertension (SBP>185, DBP.110) despite treatment

tPA Contraindications 0-3 hours

- Significant spontaneous improvement of deficit
- Minor deficit (e.g. isolated sensory symptoms, limb ataxia)
- Suspected subarachnoid hemorrhage
- Recent myocardial infarction
- GI/GU hemorrhage in the past 3 weeks
- History of previous intracranial hemorrhage
- Seizure at onset (if the deficit is felt to be post ictal)
- Very severe neurologic deficit
- Major early signs of infarct on CT (> 1/3 hemisphere)

tPA contraindications 3-4.5 hours

- Same as 0-3 hour timeframe, plus:
- Age > 80
- History of prior stroke and DM
- Any anticoagulant use (regardless of INR)
- NIHSS > 25
- CT findings involving > 1/3 MCA territory

tPA metrics

- Current goal is door to needle ≤ 60 minutes

tPA metrics

- Current goal is door to needle ≤ 60 minutes
- Soon that goal will be ≤ 45 minutes

Endovascular Therapy

- Interventions include
  - Intra-arterial tPA
  - Thrombectomy
  - Angioplasty
  - Stenting
- May be helpful in select cases when the patient presents outside the tPA window
- Recent literature supports treatment of large vessel occlusions with tPA followed by endovascular intervention

Time = Brain

- Goal door to needle < 60 minutes
- Call stroke code within 10 minutes of ED arrival
- Door to CT read within 45 minutes
- Door to lab resulted 45 minutes

Stroke Alert Process at Kaiser RWC

- EMS ring down

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”
- Weight obtained, labs drawn, CT notified, pharmacy called
- Stat noncontrast CT followed by CT with contrast for angiogram

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”
- Weight obtained, labs drawn, CT notified, pharmacy called
- Stat noncontrast CT followed by CT with contrast for angiogram
- Radiology calls back with non-con CT head result
- Consultation with neurology

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”
- Weight obtained, labs drawn, CT notified, pharmacy called
- Stat noncontrast CT followed by CT with contrast for angiogram
- Radiology calls back with non-con CT head result
- Consultation with neurology
- For appropriate patients, ED physician orders IV tPA

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”
- Weight obtained, labs drawn, CT notified, pharmacy called
- Stat noncontrast CT followed by CT with contrast for angiogram
- Radiology calls back with non-con CT head result
- Consultation with neurology
- For appropriate patients, ED physician orders IV tPA
- CT angiogram resulted.
  - For large vessel occlusion, next step is intervention.
  - If no large vessel occlusion, next step is admission.

Stroke Alert Process at Kaiser RWC

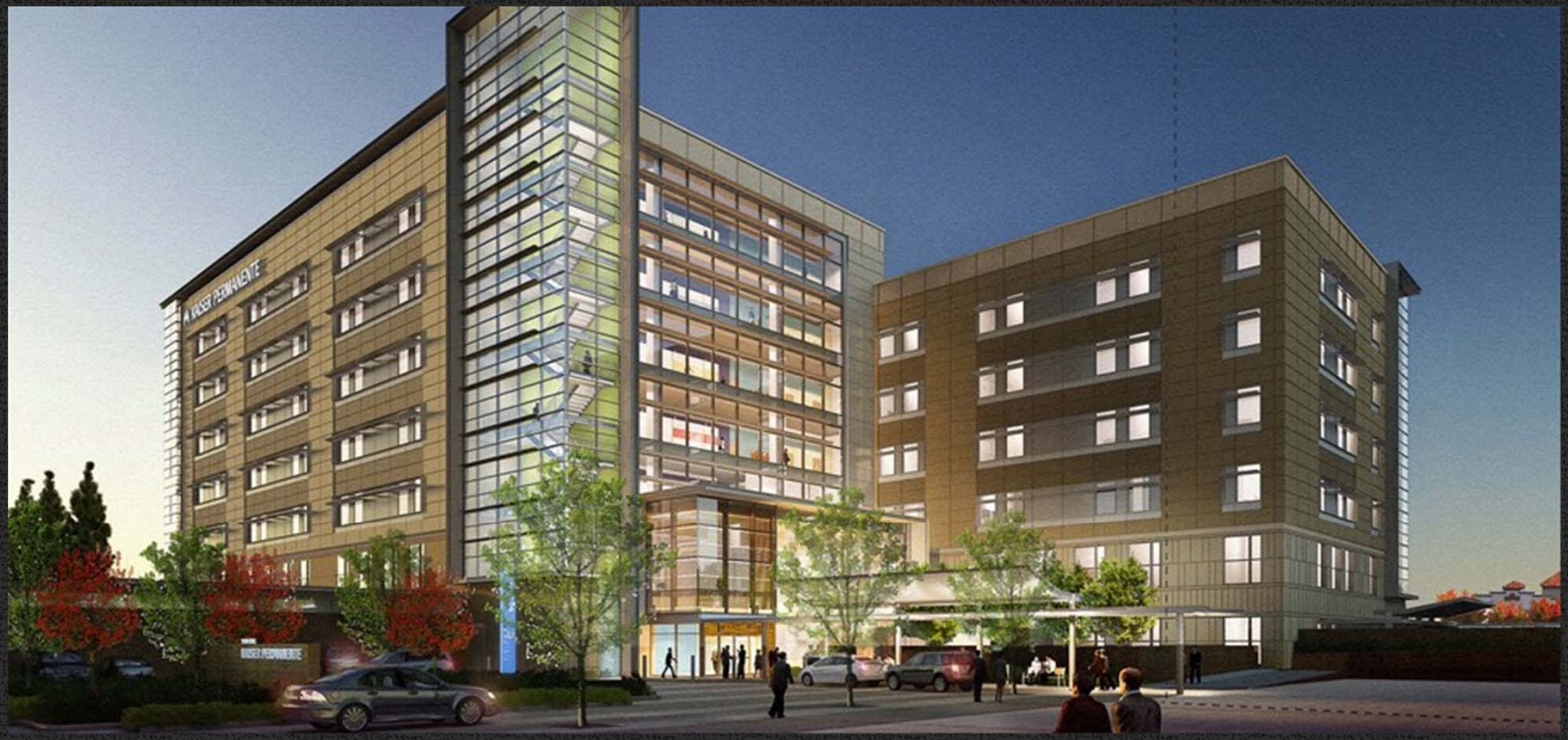
- EMS ring down
- Patient arrives
- ED physician performs brief screening exam and initiates the “Code Gray”
- Weight obtained, labs drawn, CT notified, pharmacy called
- Stat noncontrast CT followed by CT with contrast for angiogram
- Radiology calls back with non-con CT head result
- Consultation with neurology
- For appropriate patients, ED physician orders IV tPA
- CT angiogram resulted.
  - For large vessel occlusion, next step is intervention.
  - If no large vessel occlusion, next step is admission.
- GOAL door-to-needle time<60 minutes

Stroke Alert Process at Kaiser RWC

- EMS ring down
- Patient arrives
- Patient transferred to ED stretcher
- RN assessment
- ED physician performs brief screening exam and initiates the “Code Gray”
- ED MD confirms history with family, asks about contraindications
- ED MD performs NIHSS within 15 minutes of arrival
- Weight obtained, labs drawn, CT notified, pharmacy called
- Transfer to CT
- Stat noncontrast CT followed by CT with contrast for angiogram
- Transfer back to ED
- Radiology calls back with non-con CT head result
- ED MD consultation with neurology
- Bedside swallow evaluation
- ECG
- Lab calls with results
- For appropriate patients, ED physician orders IV tPA
- Second call to pharmacy to confirm tPA
- RN performs tPA checklist
- CT angiogram resulted.
  - For large vessel occlusion, next step is intervention.
  - If no large vessel occlusion, next step is admission.
- GOAL door-to-needle time<60 minutes

Category	Score/Description		Date/Time Initials	Date/Time Initials	Date/Time Initials	Date/Time Initials	Date/Time Initials
1a. **Level of Consciousness** (Alert, drowsy, etc.)	0 = Alert 1 = Drowsy 2 = Stuporous 3 = Coma						
1b. **LOC Questions** (Month, age)	0 = Answers both correctly 1 = Answers one correctly 2 = Incorrect						
1c. **LOC Commands** (Open/close eyes, make fist/let go)	0 = Obeys both correctly 1 = Obeys one correctly 2 = Incorrect						
2. **Best Gaze** (Eyes open - patient follows examiner's finger or face)	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation						
3. **Visual Fields** (Introduce visual stimulus/threat to pt's visual field quadrants)	0 = No visual loss 1 = Partial Hemianopia 2 = Complete Hemianopia 3 = Bilateral Hemianopia (Blind)						
4. **Facial Paresis** (Show teeth, raise eyebrows and squeeze eyes shut)	0 = Normal 1 = Minor 2 = Partial 3 = Complete						
5a. **Motor Arm - Left** 5b. **Motor Arm - Right** (Elevate arm to 90° if patient is sitting, 45° if supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left					
		Right					
6a. **Motor Leg - Left** 6b. **Motor Leg - Right** (Elevate leg 30° with patient supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left					
		Right					
7. **Limb Ataxia** (Finger-nose, heel down shin)	0 = No ataxia 1 = Present in one limb 2 = Present in two limbs						
8. **Sensory** (Pin prick to face, arm, trunk, and leg - compare side to side)	0 = Normal 1 = Partial loss 2 = Severe loss						
9. **Best Language** (Name item, describe a picture and read sentences)	0 = No aphasia 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute						
10. **Dysarthria** (Evaluate speech clarity by patient repeating listed words)	0 = Normal articulation 1 = Mild to moderate slurring of words 2 = Near to unintelligable or worse X = Intubated or other physical barrier						
11. **Extinction and Inattention** (Use information from prior testing to identify neglect or double simultaneous stimuli testing)	0 = No neglect 1 = Partial neglect 2 = Complete neglect						
	TOTAL SCORE						

Real Cases from the Kaiser RWC ED



Alpha 72-year-old left side weakness

- June 2015 08:00
- 72-year-old male BIBA from home at 8 am. C/o weakness left arm, left leg noted upon awaking this morning. LKWT 23:00 last night.
- PMHx HTN, cholesterol, Bell's Palsy
- Blood sugar
- Exam
  - Vitals BP 179/89, HR 88, RR 16, T 36.6, O2 Sat 98% RA
  - Left facial droop, left arm weak, left leg weak, dysarthria
  - NIHSS = 11

Alpha 72-year-old left side weakness

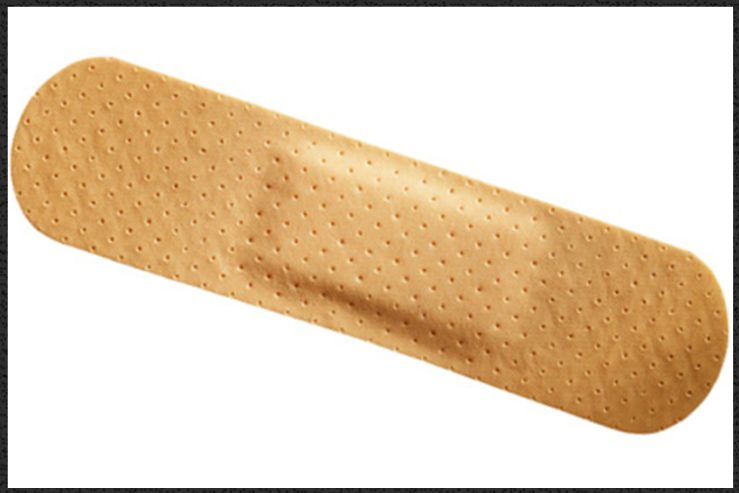
- Labs unremarkable
- CT demonstrates no acute intracranial finding. Dense appearance of the right MCA may reflect MCA occlusion.

Alpha 72-year-old left side weakness

- Intervention?

Alpha 72-year-old left side weakness

- Patient admitted, treated with aspirin and Plavix
- At time of discharge, patient left with residual left facial droop, weakness of left arm, able to ambulate with a cane
- Patient discharged to SNF for rehab



Bravo 78-year-old left side weakness

- May, 2015 19:41
- 77-year-old man BIBA from home for left side weakness. LKWT 17:30.
- PMH HTN, GERD, CAD, hyperlipidemia
- Blood glucose 91
- Exam
  - BP 200/110, P 81, R 20, T 36.9 C, SpO2 99% RA
  - Alert, oriented, left facial droop, left arm weak, left leg weak
  - NIHSS 12

Bravo 78-year-old left side weakness

- CT
  - No hemorrhage
- CTA
  - Occlusion of the right internal carotid artery. Occlusion of the right middle cerebral artery.

Bravo 78-year-old left side weakness

- Time for tPA and intervention?

Bravo 78-year-old left side weakness

- Time for tPA and intervention?
- Remember the BP?

Bravo 78-year-old left side weakness

- Time for tPA and intervention?
- Remember the BP?
- 200/110

Bravo 78-year-old left side weakness

- Labetalol given, BP 165/81
- tPA given
- Transfer to NIR
- Thrombectomy performed

Bravo 78-year-old left side weakness

- Outcome
- 6/2/2015 At time of discharge, ambulatory with a walker. Discharged to SNF for rehab
- 9/8/2015 Follow up, independent ADLs, walks without assistive device

Bravo 78-year-old left side weakness

- 17:30 LKWT
- 19:41 arrival
- 19:42 Code Gray called
- 20:05 CT resulted
- 20:18 tPA administered
- Door to needle time 37 minutes
- Treatment provided 2 hours 48 minutes after onset

Delta 64-year-old man with AMS

- July 2015 7:55 am
- 64-year-old man BIBA from home with altered mental status. Last seen well 6:45 am. On EMS arrival, unconscious, minimally responsive, snoring respirations.
- PMH HTN
- Blood glucose 107
- Exam
  - Vitals BP 173/102, P 77, R 14, Temp 37
  - Eyes closed, snoring respirations, not following commands, withdraws to pain
  - NIHSS 26
  - GCS 6

Delta 64-year-old man with AMS

- What needs to happen next?

Delta 64-year-old man with AMS

- Code gray
- Intubated for airway protection
- Neurologist calls during intubation
- CT, CTA

Delta 64-year-old man with AMS

- Non con head CT no bleed

Delta 64-year-old man with AMS

Decision time

Delta 64-year-old man with AMS

Decision time

- LKWT 06:45
- CT result time 08:00

Delta 64-year-old man with AMS

Decision time

- LKWT 06:45
- CT result time 08:27
- D/w neurology, give IV tPA
- CTA

Delta 64-year-old man with AMS

CT angiogram result

- Occlusive thrombus in the distal basilar artery and right vertebral artery

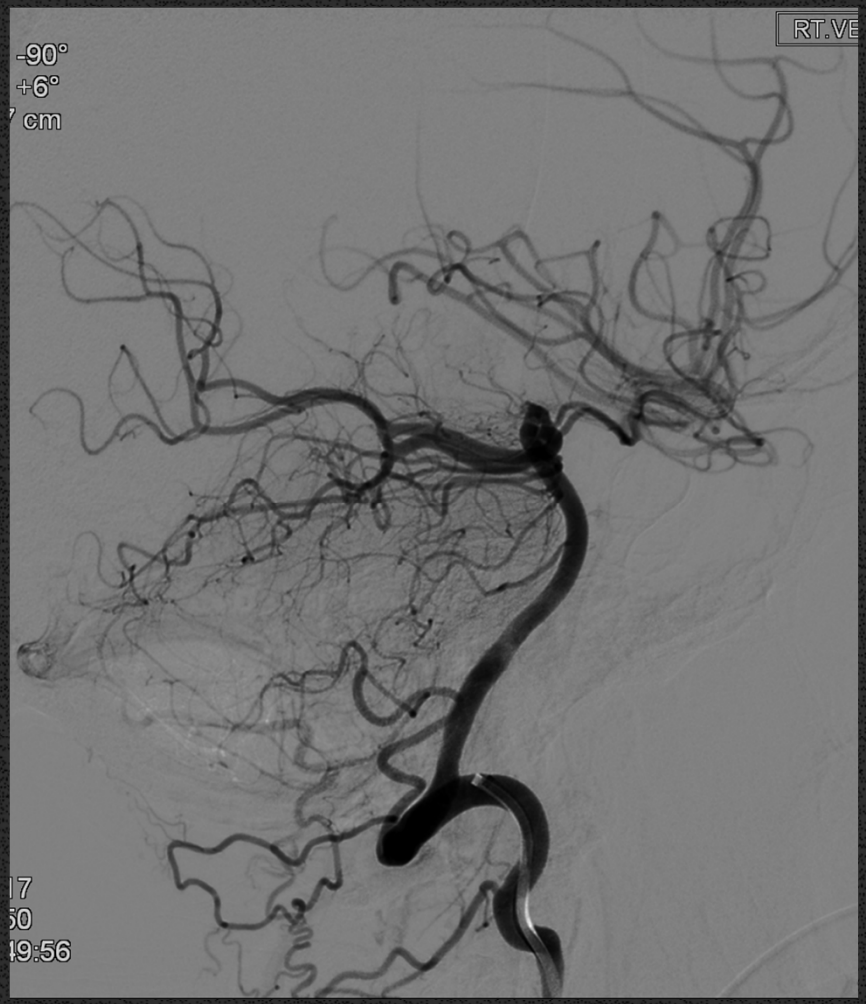
Delta 64-year-old man with AMS

- IV tPA administered
- Then taken to neurointerventional lab

Delta 64-year-old man with AMS

- Thrombectomy of the right vertebral artery

Delta 64-year-old man with AMS



Delta 64-year-old man with AMS

Outcome

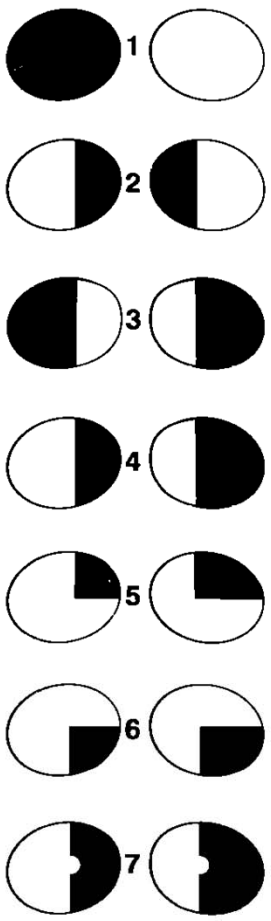
- At time of discharge, no weakness or cognitive deficit
- Discharged to home
- One month later, doing well, living independently

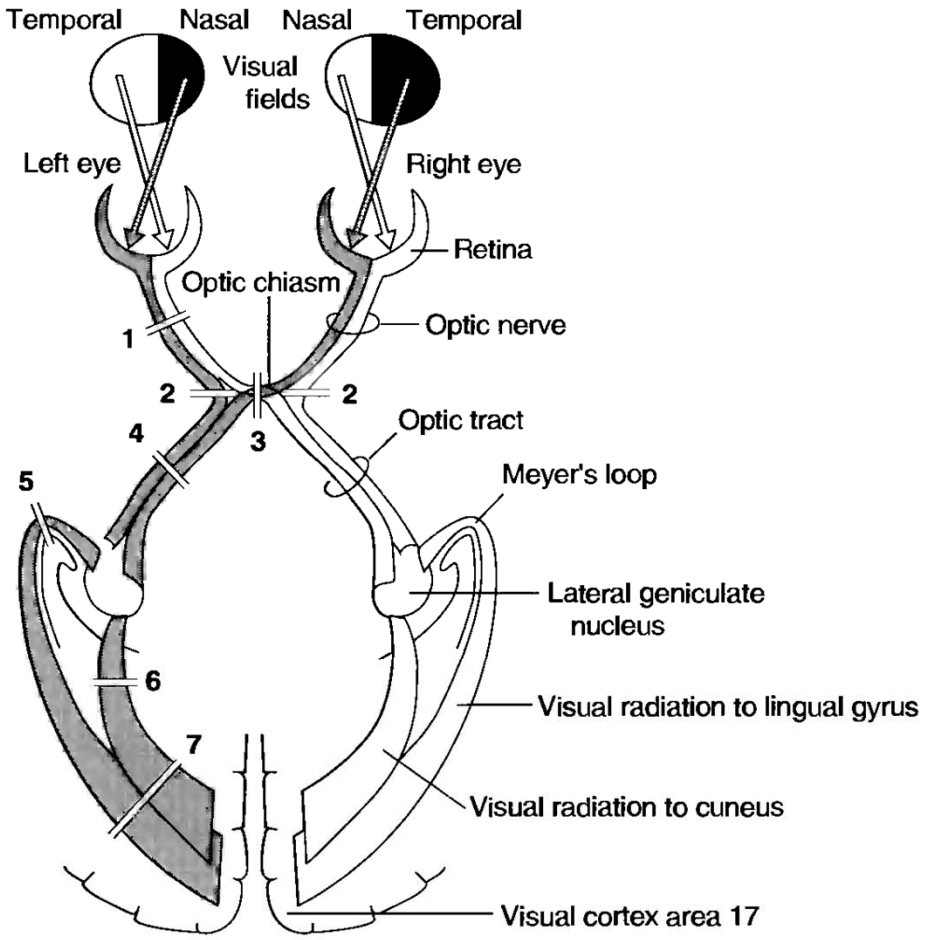
Delta 64-year-old man with AMS

- LKWT 06:45
- Arrival to ED 07:55
- tPA given 08:53
- Door to Needle time 58 minutes
- tPA provided 2 hours and 8 minutes after LKWT

Echo 31-year-old woman with slurred speech

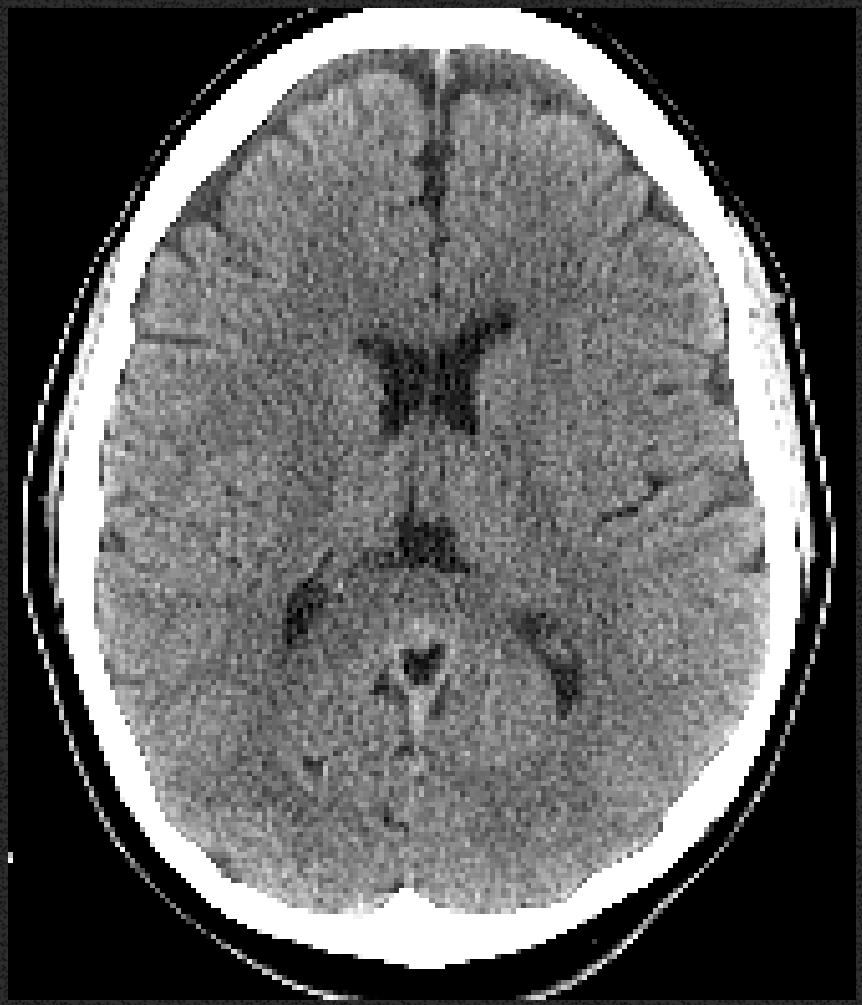
- Nov 2013 13:25
- 31-year-old female presented to ED by private vehicle c/o sudden onset slurred speech and blurry vision 55 minutes prior to arrival. Also c/o headache and neck pain x 1 week.
- PMH: HTN, migraine
- Blood sugar: 76
- Exam
  - BP 185/130, P 78, R 19, T 37.1
  - Alert, oriented, slurred speech, aphasia, right side hemianopsia
  - NIHSS 4


1
2
3
4
5
6
7


Temporal
Nasal
Nasal
Temporal
Visual fields
Left eye
Right eye
Retina
Optic chiasm
Optic nerve
Optic tract
Meyer's loop
Lateral geniculate nucleus
Visual radiation to lingual gyrus
Visual radiation to cuneus
Visual cortex area 17
1
2
2
3
4
5
6
7

Echo 31-year-old woman with slurred speech

- CT head non contrast no bleed



Echo 31-year-old woman with slurred speech

- CTA
  - Left vertebral artery dissection at the C5-C6 level and focal high-grade stenosis within the proximal M3 segment posterior branch of the left middle cerebral artery

Echo 31-year-old woman with slurred speech

- When did the symptoms start?
- NIHSS = 4
- Hypertensive 185/130!
- Dissection!!

Echo 31-year-old woman with slurred speech

- Discussion with neurology
- tPA given

Echo 31-year-old woman with slurred speech

- Outcome
  - Symptoms slowly resolved in the ICU
  - Anticoagulated with warfarin with enoxaparin bridge
  - No obvious reason for the dissection

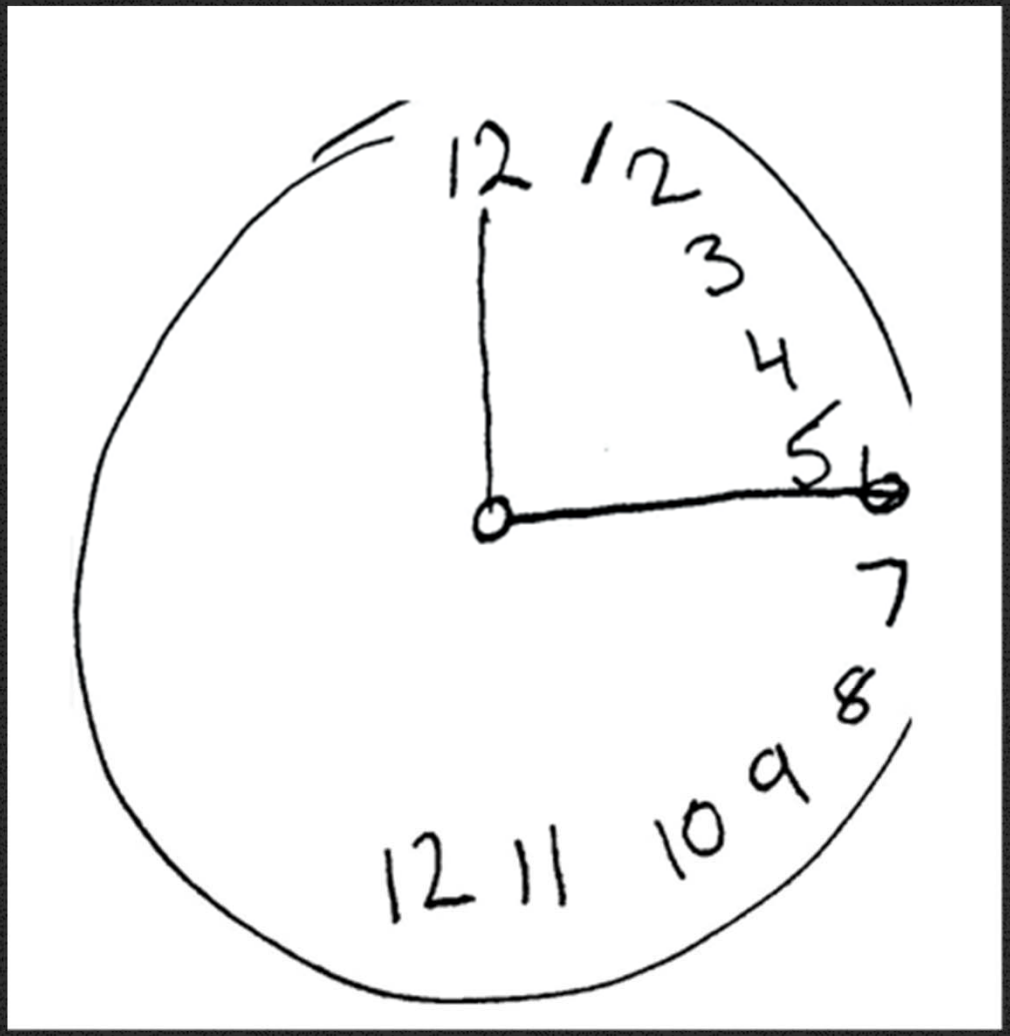
Echo 31-year-old woman with slurred speech

- LKWT 12:30
- ED arrival 13:25
- tPA given at 14:43
- Door to needle 78 minutes
- Treatment provided 2 hours and 13 minutes after onset of symptoms

Foxtrot 79-year-old female AMS

- September 2015 12:24
- 79 yo female biba from home with altered mental status. LKWT 9 am. At 9 am, she drove her car to see a friend, drove home, on return home crashed her car into the back of the garage. On EMS arrival, patient confused.
- PMH: stroke one year ago, DM, HTN
- Blood sugar 204
- Exam
  - BP 156/60, HR 79, RR 20, T 35.7, O2 Sat 95% RA
  - Appears distressed, confused, left visual field cut, aphasic and dysarthric, neglect
  - NIHSS 8

Foxtrot 79-year-old female AMS



Foxtrot 79-year-old female AMS

- Code gray activated

Foxtrot 79-year-old female AMS

- CT – old occipital infarct
- CTA – Atherosclerosis. No significant arterial stenosis or occlusion.

Foxtrot 79-year-old female AMS

- Time for tPA?

Foxtrot 79-year-old female AMS

09:00 Last known well time. However, patient drove her car home and arrived home at 12:00

12:24 Patient arrives to ED, history is limited due to altered mental status. Known to have old stroke, how new are the deficits today?

12:40 CT resulted, old occipital infarct. Meanwhile, symptoms are waxing and waning.

13:00 Family confirms speech changes are new, vision changes are probably worse. Time is now 4 hours since LKWT. To give or not to give tPA? Neurology at bedside, explained risks/benefits to family, decision made to give tPA.

Foxtrot 79-year-old female AMS

Outcome

- Found to have atrial fibrillation, appropriate treatment recommended
- Almost complete resolution of symptoms
- Discharged to home with home PT, OT

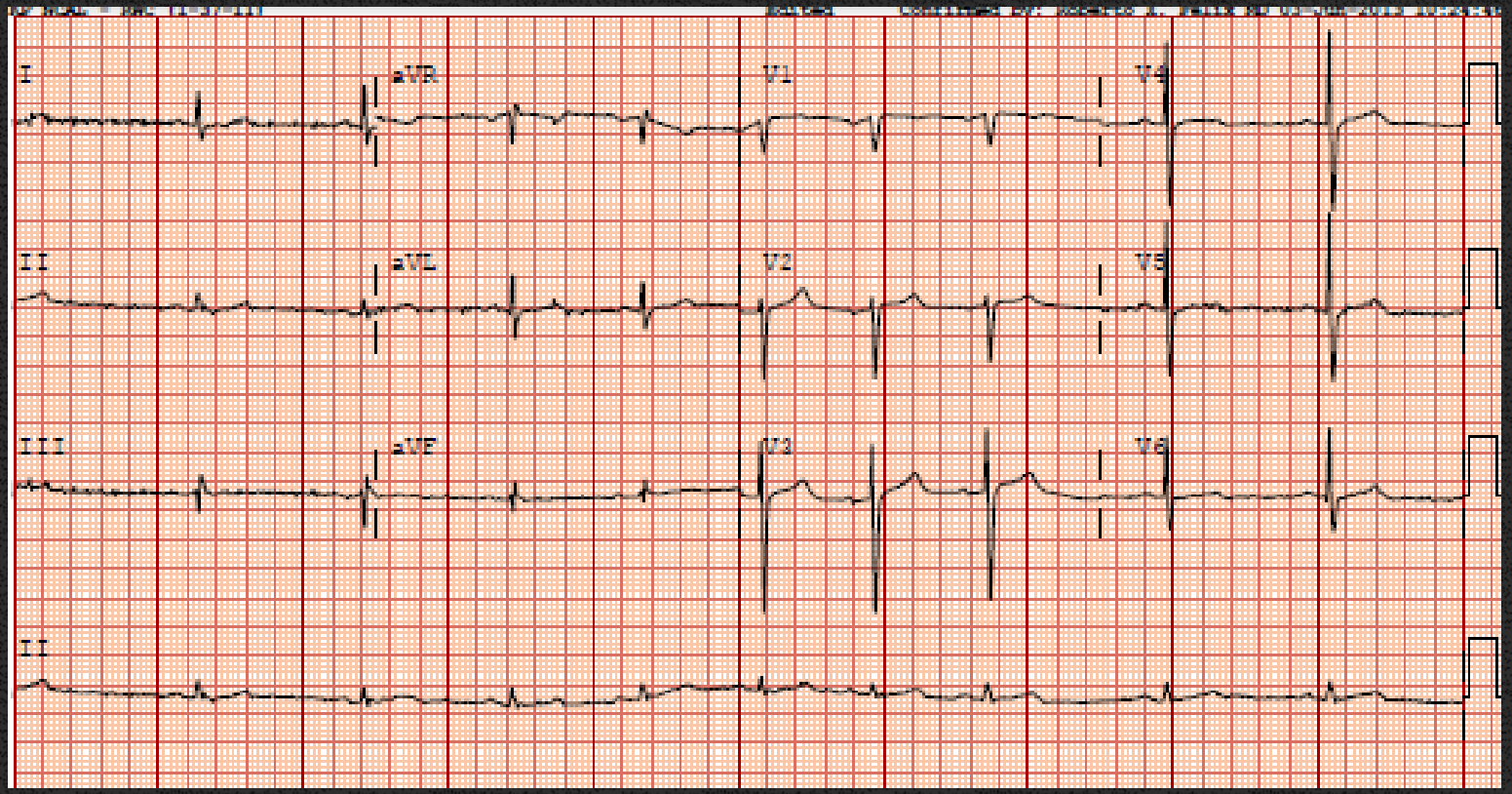
Foxtrot 79-year-old female AMS

- LKWT 09:00
- ED arrival 12:24
- tPA given 13:14
- Door-to-needle 50 minutes
- Treatment given 4 hours and 14 minutes after LKWT

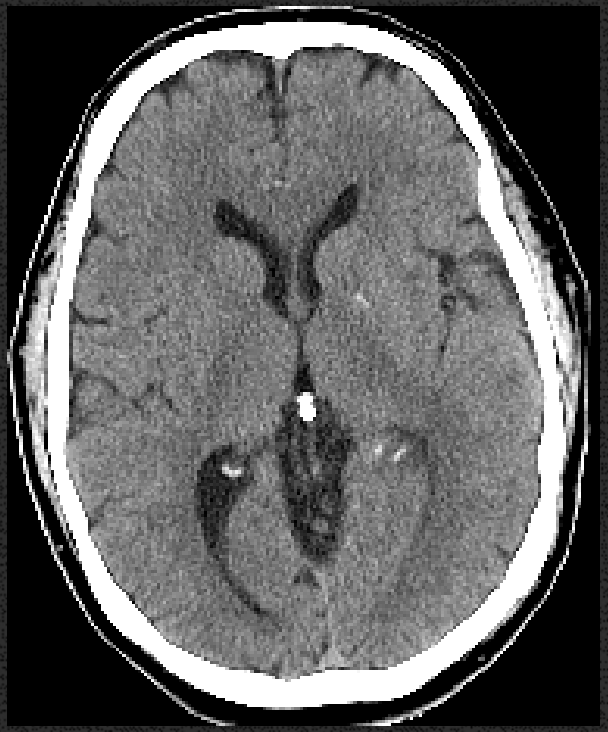
Kilo 52-year-old man with chest pain and left leg weakness

- June 2013
- 52-year-old man BIBA from home with acute onset chest pain x 30 seconds, sharp and severe. Followed by acute onset left leg numbness and weakness.
- PMH: HTN, hyperlipidemia
- Blood sugar 161
- Exam
  - BP 140/88 P 60 R 22 T 36.8
  - Ill-appearing, weak in the left leg
  - NIHSS 5 (weakness and loss of sensation left leg)

Kilo 52-year-old man with chest pain and left leg weakness



Kilo 52-year-old man with chest pain and left leg weakness



Noncontrast scan negative

Kilo 52-year-old man with chest pain and left leg weakness

- LKWT 13:55
- ED arrival 14:51
- Results 15:35
- Neurology recommends tPA barring any contraindications

Kilo 52-year-old man with chest pain and left leg weakness

- t-PA ordered @ 15:18
- Radiology calls back at 15:25 and notes the following:

- Type A/B dissection extending into the left common carotid artery with severe stenosis of the common carotid artery and complete occlusion of the left ICA distal to the bifurcation
- Dissection also involves left subclavian artery

Kilo 52-year-old man with chest pain and left leg weakness

- t-PA NOT given (wasted)
- CV surgery recommended nicardipine gtt, CT chest
- CT chest/abd/pelvis - dissection extends down to the iliac bifurcation
- Transferred emergently to facility with CV surgery
- Underwent emergent repair of Type A dissection
- Flow re-established to viscera and lower extremities
- Developed ischemic colitis and rhabdomyolysis
- Underwent bilateral leg fasciotomies, then subtotal colectomy and bilateral leg amputations
- Died 2 days after event

Lima 88-year-old female

- July 2015 8:28 am
- 88 yo female BIBA from home with right side weakness. LKWT 7:30 am.
- PMH HTN, CHF
- Blood glucose 112
- Exam
  - BP 120/45, P 54, T 36.4 C, O2 Sat 98% RA
  - Right side weakness, right side neglect, aphasic
  - NIHSS 25

Lima 88-year-old female

- Code gray activated

Lima 88-year-old female

- CT non contrast
  - No hemorrhage
- CTA
  - Thrombosed left internal carotid. Left MCA is unopacified.

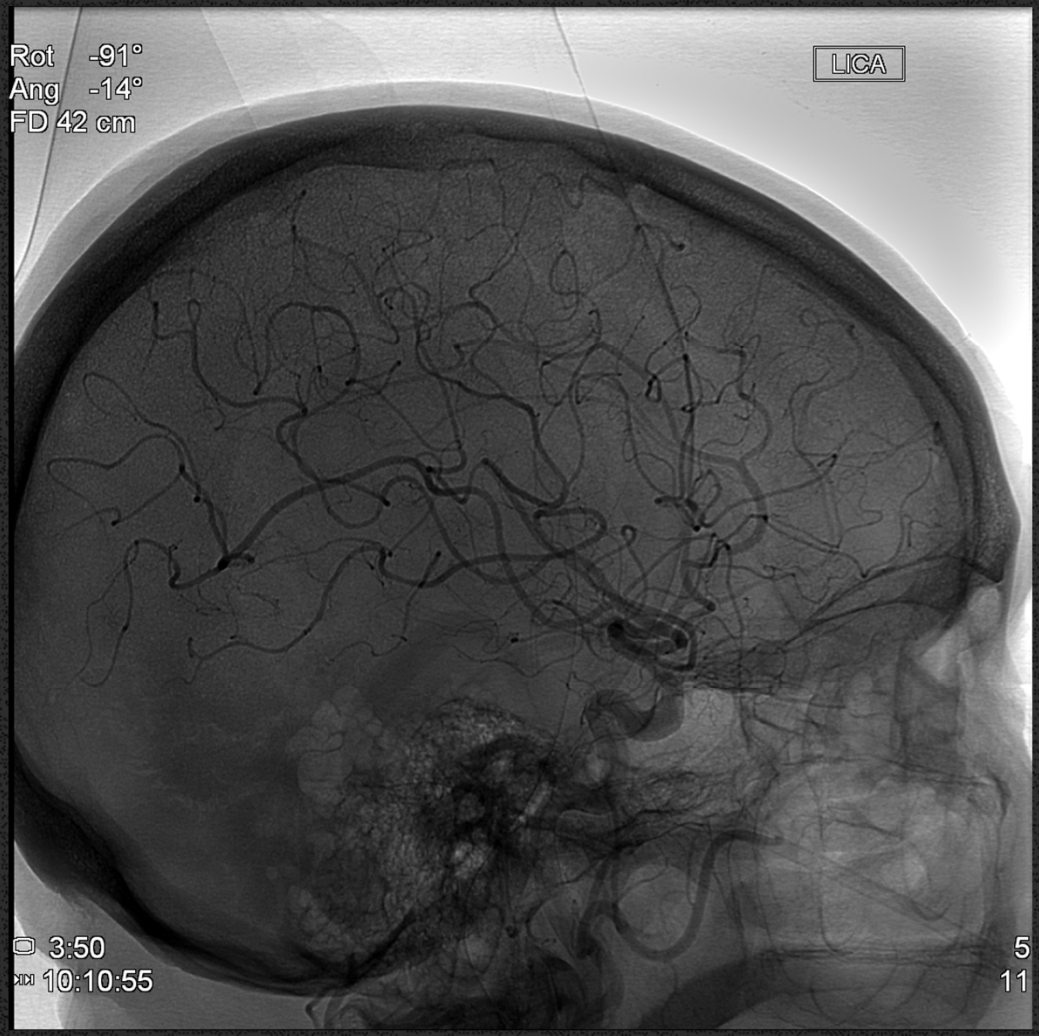
Lima 88-year-old female

- 0830 Patient arrives at ED. LKWT 0730.
- 0843 CT resulted
- 0844 d/w Neurology, give tPA
- 0858 Son arrives. Clarifies LKWT as 6 am.
- 0903 Gets tPA
- 0907 Transfer to NIR for thrombectomy

Door to needle time 33 minutes

Treatment time 1 hour 33 minutes after onset of symptoms

Lima 88-year-old female



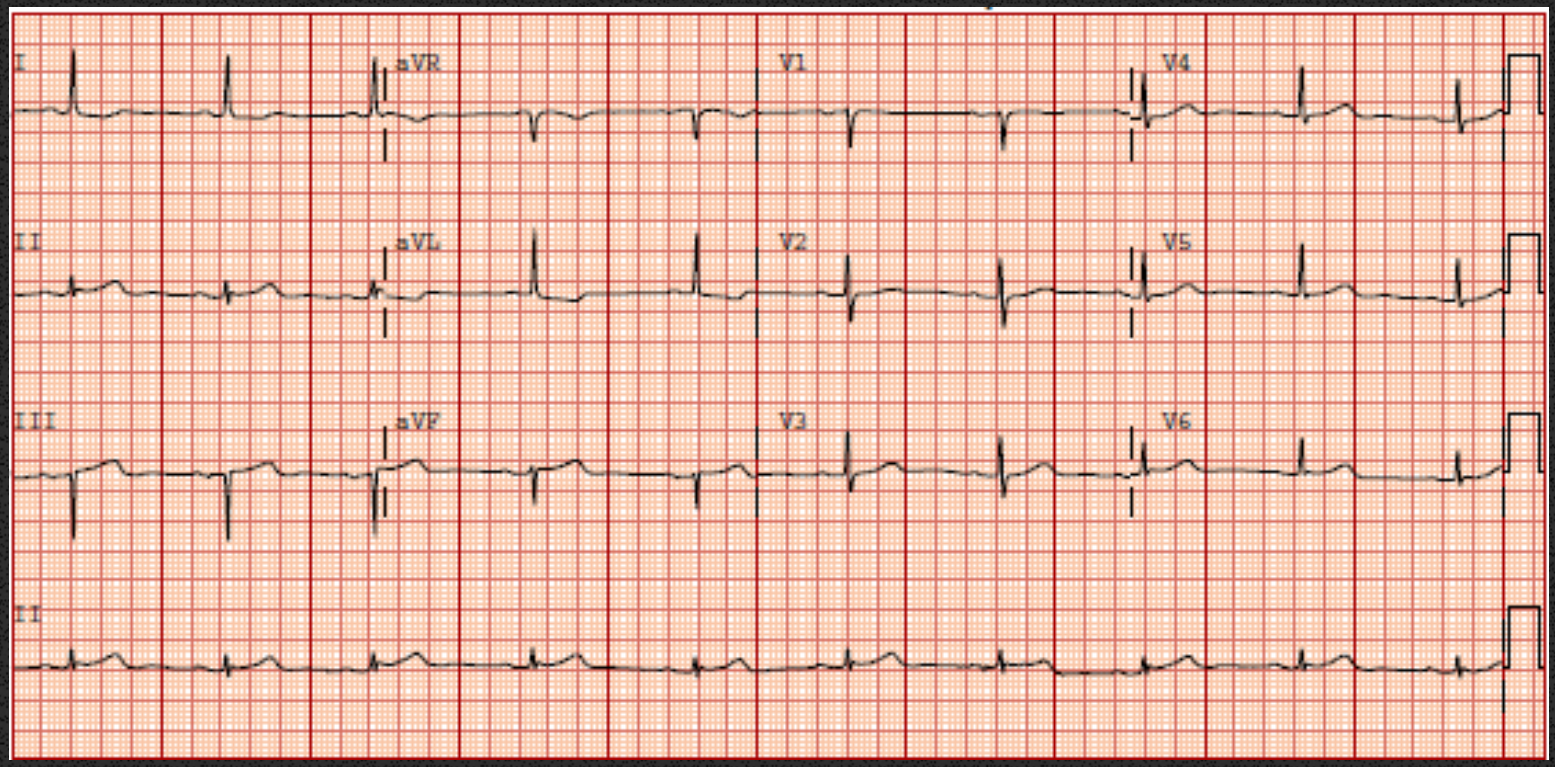
Lima 88-year-old female

- Outcome
  - Found to have paroxysmal atrial fibrillation. Started on Coumadin 10 days after stroke.
  - At time of discharge, she had some improvement of the right side weakness, still aphasic and requiring tube feeding
- Discharge to SNF for rehab
- Follow up 9/2015
  - Ambulating, performing some ADLs, tolerating po diet

Quebec 91-year-old female left hemiparesis

- February 2014
- Elderly woman from home BIBA Code 3 with acute left face/arm/left leg weakness with right eye deviation 50 minutes prior to arrival.
- Had stroke within past 3 months treated at RWC with aspirin/statins, discharged to home 1 mo. ago. Baseline A+Ox3.
- PMH: HLD, DM, stroke, CAD
- Blood sugar: 192
- Exam:
  - Vitals 96.6 18 57 175/57
  - ill-appearing
  - NIHSS: 35 (mostly for generalized unresponsiveness, flaccidity, aphasia)

Quebec 91-year-old female left hemiparesis



NSR 58, no ischemic changes

CBC, Chem 7, INR WNL

Quebec 91-year-old female left hemiparesis

CT head – negative for acute changes

CTA not done due to IV contrast allergy noted in HealthConnect

Quebec 91-year-old female left hemiparesis

- Decision time
  - LKWT 15:30
  - ED arrival 16:19
  - Results 16:57 – 1 hour 27 minutes after onset
  - Family states patient is Full Code

Quebec 91-year-old female left hemiparesis

Outcome

- t-PA NOT given for:
  - Last stroke within the past 3 months
  - Large NIHSS score
- Neuroscience admitted patient and reviewed grave prognosis with family
- Because family was certain patient did not want to survive with “disability,” comfort measures initiated
- Patient died within 24 hours

Tango 60-year-old female

- Oct 2015 11:55 am
- 60 year old female left side weakness onset 8 am today.
- PMHx HTN, thyroid disease
- Blood sugar 90
- Exam
  - BP 156/82, HR 92, T 36.1, RR 20, O2 Sat 98% RA
  - Awake, alert, oriented x 3, left facial droop, left arm weak, left leg weak
  - NIHSS 9

Tango 60-year-old female

- Stroke symptoms presenting to the ED at 4 hours after onset
- Code Gray called, patient immediately taken to CT, labs drawn, tPA ordered to expedite care

Tango 60-year-old female

- CT – no blood
- CTA – No acute arterial stenosis or occlusion

Tango 60-year-old female

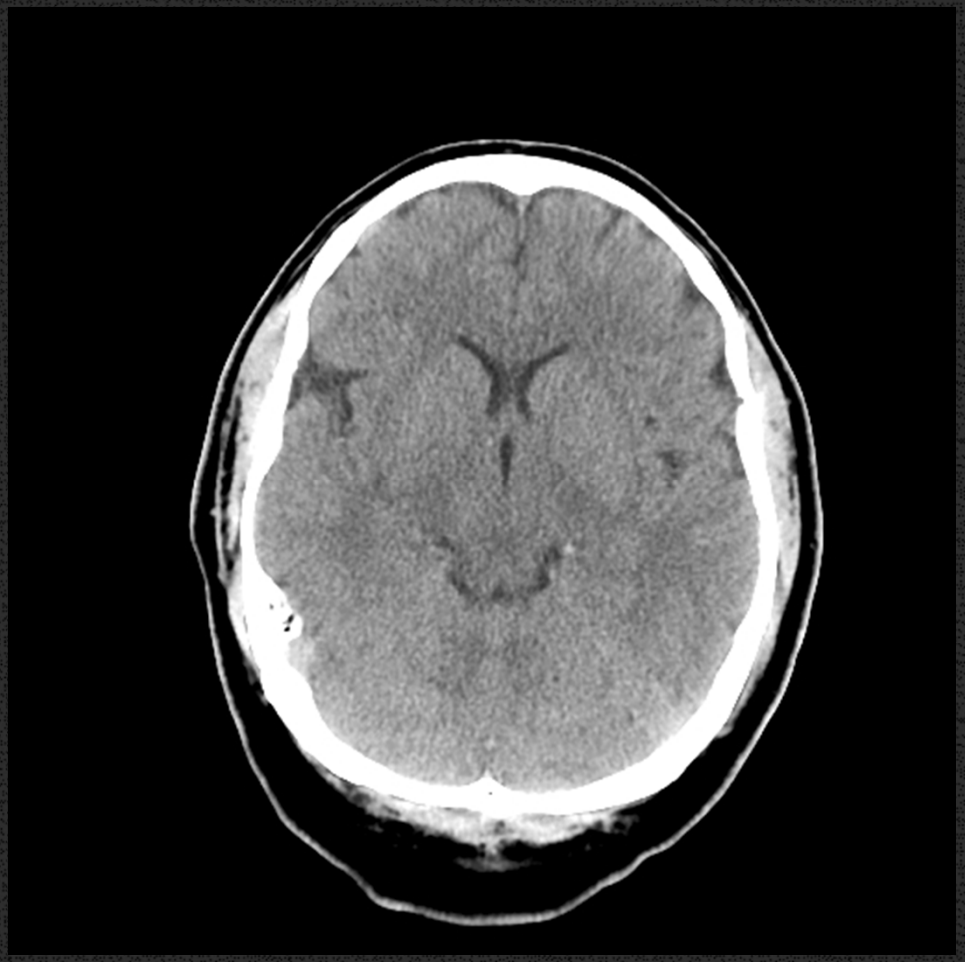
- Upon return from CT, patient reports she had similar symptoms in the past which resolved completely and was diagnosed with a migraine
- Neurology advised no tPA
- After observation, patient spontaneously improved. Complete resolution of her neurologic symptoms.
- tPA was wasted

Yankee 50-year-old man

- March 2015 07:28
- 50 yo male biba from home c/o right side weakness x 40 minutes.
- PMH DM2
- Exam
  - BP 146/88 HR 72, T 36.6 C, RR 17, O2 Sat 98% RA
  - Right facial droop, right arm weak, right left weak, right hemineglect, aphasia
  - NIHSS 9

Yankee 50-year-old man

- Left PCA and L vertebral artery thrombus



Yankee 50-year-old man

- Treated with IV tPA
- The thrombus is not amenable to intervention
- Patient admitted to the ICU

Yankee 50-year-old man

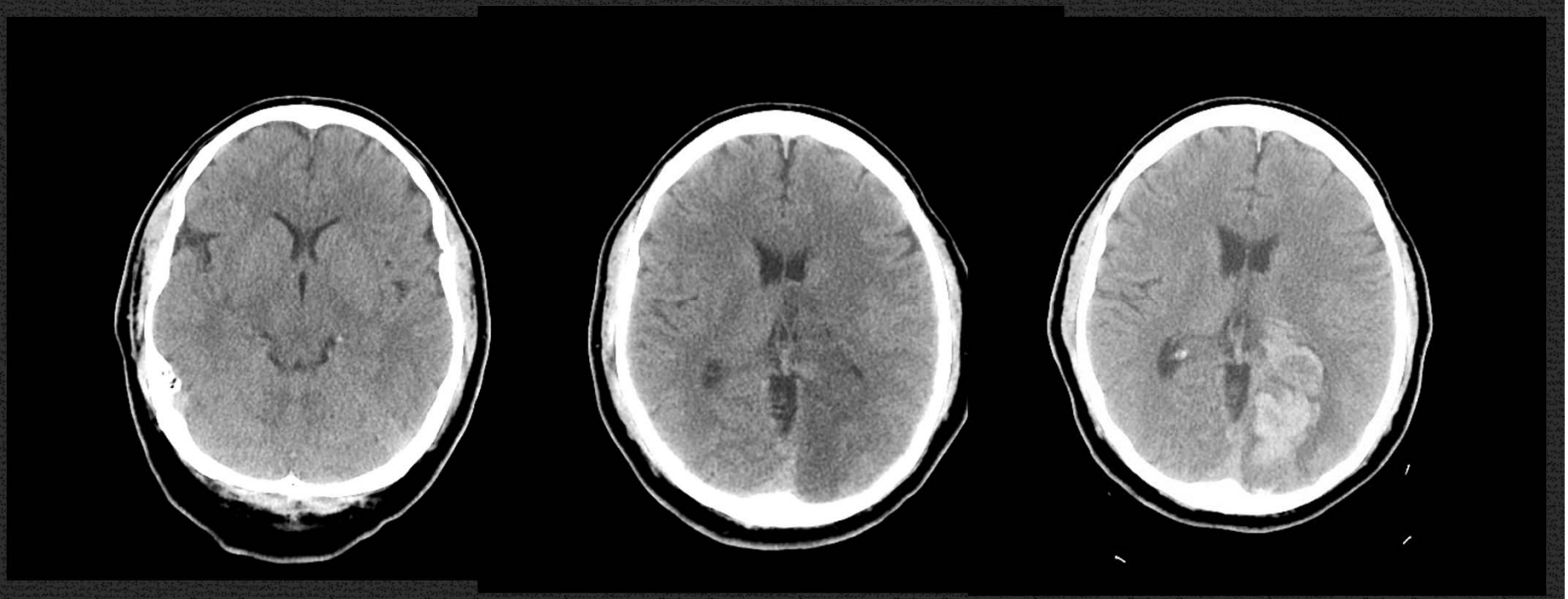
- 06:50 LKWT
- 07:27 arrives ED
- 08:03 tPA given
- Door to needle time 36 minutes
- Treatment 1 hour 13 minutes after onset of symptoms

Yankee 50-year-old man

Outcome

- Patient has mild improvement, still with speech difficulties, memory problems and visual field cut. He is discharged to home on aspirin with family to provide 24-hour supervision. Outpatient OT.
- 2 weeks later develops severe headache. Presents to clinic. No new neuro deficits.
- CT demonstrates hemorrhage in the recent infarct area.
- Patient is readmitted.

Yankee 50-year-old man



Yankee 50-year-old man

- September 2015
- Lives at home with wife and children, able to care for himself and his children. Still with some cognitive difficulties and a visual field cut
- Back at work part time – IT at a big area tech company

Takeaway Points

Time is brain

Determine accurate LKWT

Treat hypertension early

CT followed by CTA unless contraindication

Beware stroke mimics

tPA can improve outcomes