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 $\leq 60$ minutes
tPA metrics

- Current goal is door to needle $\leq 60$ minutes
- Soon that goal will be $\leq 45$ 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
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
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?
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