

*SAN MATEO COUNTY 2016 STROKE SYMPOSIUM: A MATTER OF TIME*

# **Implementation of Telemedicine Services: Trials, Tribulations and Success**

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**Prasha Govindarajan, MD**, *Associate Professor of Emergency Medicine Stanford University School of Medicine*

**David Tong, MD**, *Director, Telemedicine Network, California Pacific Medical Center*

**George Oldham, MD**, *Medical Director, Emergency Department, Dignity Health Sequoia Hospital*

**Jeffrey Klingman, MD**, *Neurologist, Kaiser Permanente*

**Jenny Im, RN**, *Stroke Coordinator, Mills-Peninsula Health Services*

**Jake Jung, PharmD**, *In-patient Pharmacy Supervisor, Kaiser Permanente Redwood City Medical Center*

# Telemedicine Panel

Prasanthi “Prasha” Govindarajan  
Associate Professor of Emergency Medicine  
Stanford University School of Medicine

# Background

- Time is brain – Stroke is time-sensitive like OHCA, multi-organ trauma and ST elevation MI.
- Prehospital care is an important component of acute stroke treatment pathways
- Stroke scales perform better in validation studies than in real time
- Innovative methods to improve stroke care

# Telemedicine

- Mobile Stroke Units is a novel concept but has limited generalizability
- Another innovative concept is extending telemedicine into the field
- La Monte et al. proposed this in early 2000's
- Technology was primitive but results showed good reliability and agreement between providers

# Telemedicine

- PreSSUB – Prehospital telemedicine group from Brussels, BE
- The goals of this study were similar to ours
  - Recognition of stroke
  - Assessment of stroke severity
  - Collection key information from patients that may influence treatment decisions
  - Large Vessel Occlusion
  - Communication with neurologist and pre-notification

# Telemedicine

Pilot study tested on healthy volunteers

- Stability of prehospital wireless connectivity
- Developed and pilot tested a simpler prehospital stroke scale called UTSS
- Multi-lingual decision support system (Dutch, English and French)
- Transmission of a prehospital record electronically to the vascular neurologist
- Prenotification through a text messaging system

# Telemedicine

- Results showed a median of 9 minutes for the telecommunication
- Stroke neurologists identified 12 stroke cases using teleconsultation. 10 of those were identified as stroke in the hospital
- 100% transmission of prehospital case reports
- Overall, demonstrated successful results in use of prehospital telemedicine

# Neurology Telemedicine

George Oldham, MD, FACEP

Sequoia Hospital





# Stroke Teleneurology Success Case Study

## Atypical Presentation of Cerebral Vascular Issue

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- 69 yo male LKWT 9:00pm awoke at 2:45 am with profound confusion, agitation, difficulty speaking, and mild R sided weakness.
- Recent Dx of URI and started on Cipro the day before.
- Per wife, the patient was completely normal and without any complaints when he went to bed at 9:00 pm.

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- 911 called. AMS but no local deficits. Medics note a glucose of 76 and give glucola without improvement.

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- PMH: CAD s/p CABG, T2DM, HTN, Hyperlipidemia, GERD, BPH, Anxiety
  - Meds: ASA 81, Lipitor, Plavix, Prilosec, Amitiza, Flomax, Ranexa, Wellbutrin, Metoprolol
  - Soc: Married, - tob, +etoh, Volunteer at Sequoia
  - Fam: Dad, Brain CA, Mom, Pancreatic CA

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- BP 102/61, HR 73, RR 19, T 36.3, Sat 100% RA
  - Confused, agitated, not following commands, 1 or 2 word responses that seem appropriate.
  - Did recognize ERMD and wife. EOMI,? sl R facial droop, = grips, NI motor and sensory all Ext.

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- Labs all normal,
  - Urine drug tox Negative
  - EKG: NSR 77, NS ST-T wave abnormalities

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- Non con head CT:
  - No ICH, No evidence of acute ischemia or infarct.
  - Chronic small vessel ischemic disease within the subcortical and periventricular white matter.

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- Tele-neurology Exam:
  - NIHSS score: 7
  - 1b LOC questions: 2, 1c LOC Commands: 2, 5b Motor R arm: 1 (drift), 9 Best Language: 2 (severe aphasia)
  - CT EVAL: L M2 hyperdense sign. CTA not done
  - Note a candidate for t-PA ( LNWT now 6 hours)
  - Clot retrieval still an option

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- Transfer to SUH
  - MR showed L MCA clot
  - Successful clot retrieval



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- 100% resolution of all neurologic findings.

# Benefits of Teleneurology for Stroke Patients at Dignity Health Sequoia Hospital

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- **24/7 neurological consultation available**
- **All suspected stroke patients receive teleneurology consultation**
- **Response time is excellent- had to work collaboratively with teleneurology as to the timing of the call to the teleneurologist for a consultation to minimize delays on both ends**
- **Teleneurologists assist in managing the process for transfer to Stanford University Hospital for endovascular treatment or neurosurgery**
- **100% up time with robot and network**
- **Teleneurology consultation report available in the medical record within 30 minutes of consultation**
- **Data retrieval for statistical analysis**

# KPNC Stroke EXPRESS

EXpediting the PROcess of Evaluating & Stopping Stroke  
**Role of the Teleneurologist**



Jeffrey G. Klingman, MD

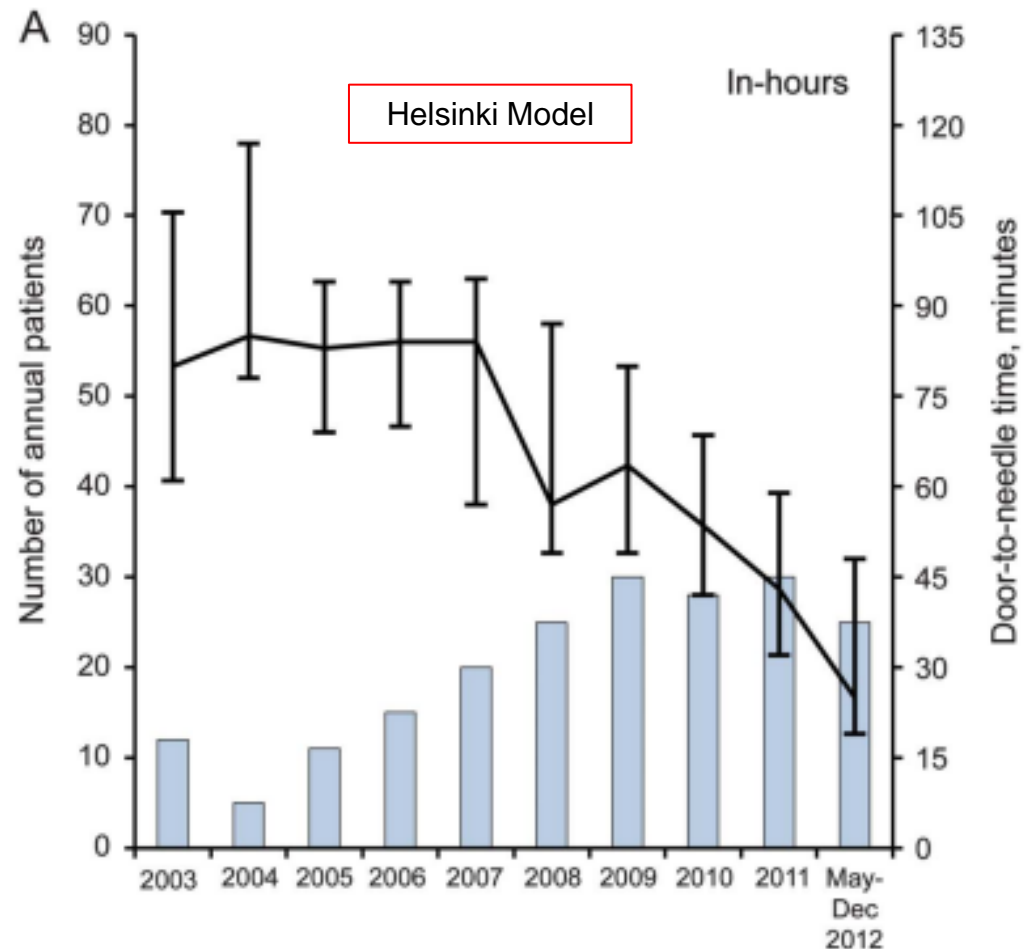
# Time is Brain

2 Million nerve cells die per minute

Better outcomes with faster Door to Needle

Better outcomes with endovascular treatment of LVO's

Better outcomes with faster endovascular treatment



# Time is brain : The key to speed...

- Key components = early notification and involvement of stroke neurologist
- Don't room – straight to CT
- Alteplase in CT



- **Problem: small volumes cannot justify in house stroke neurologist**

# Solution: Video Helsinki

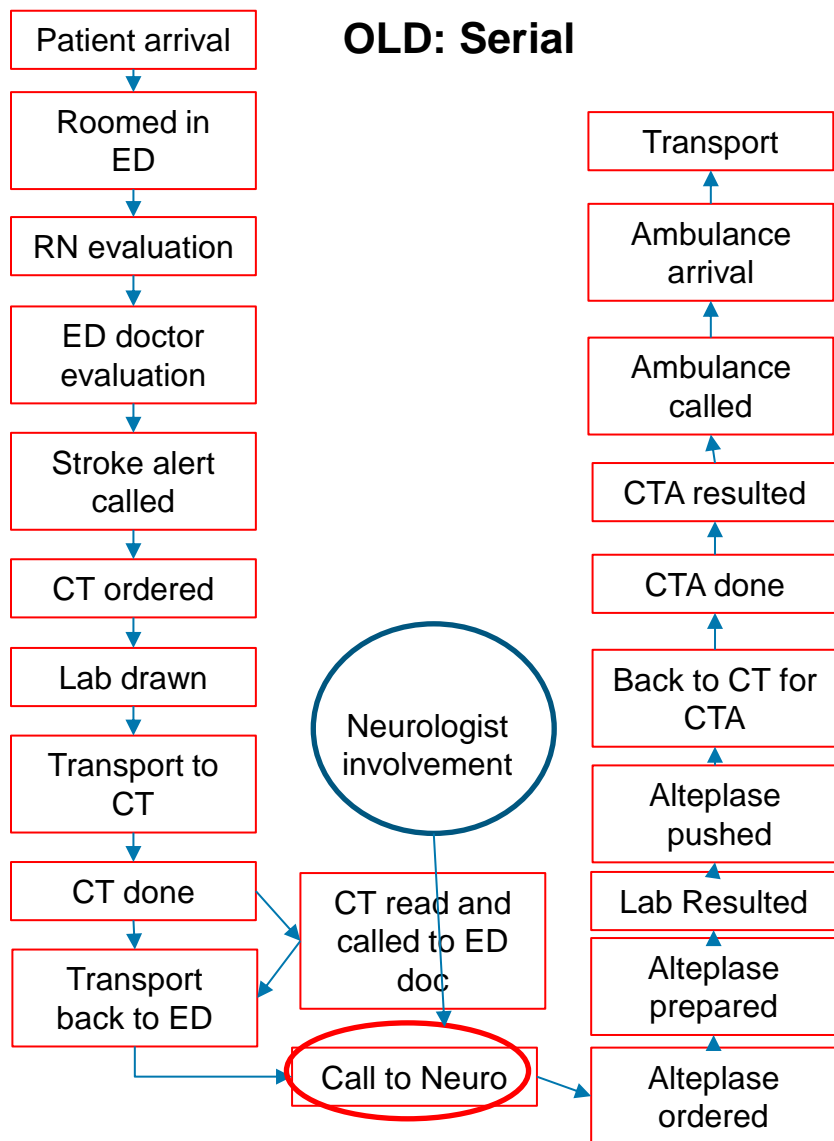


**Video consultation + redesigned process**

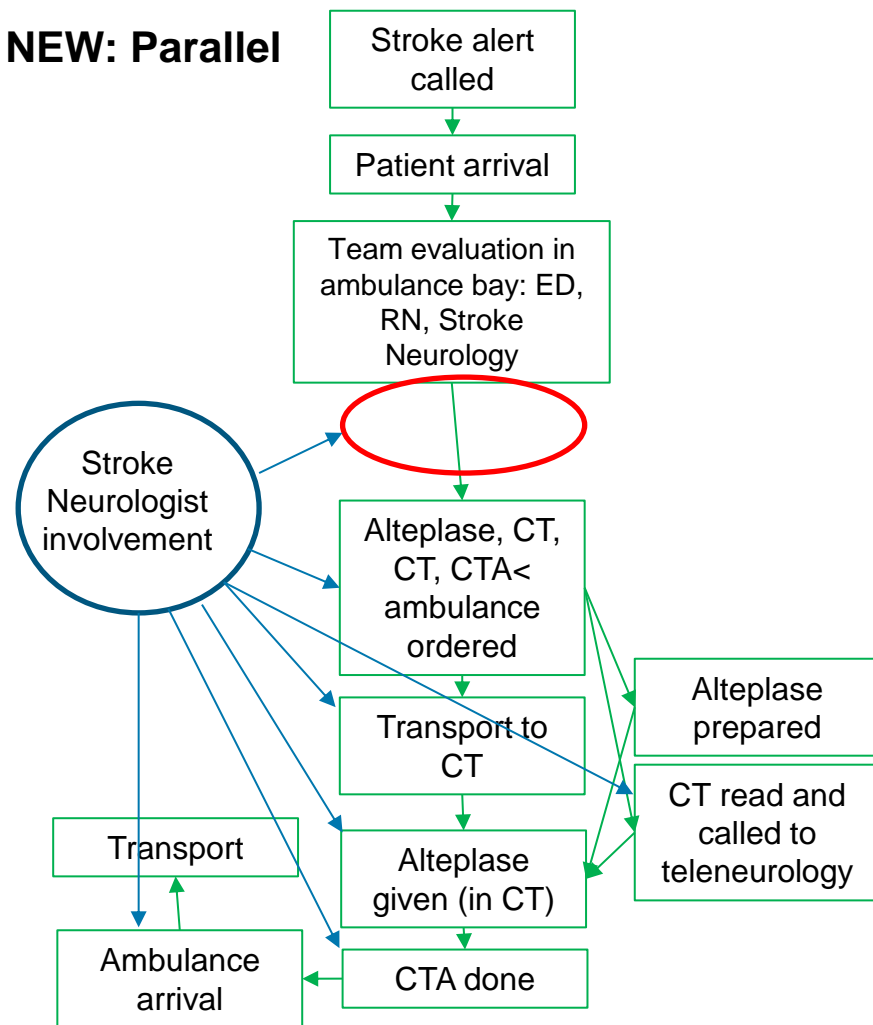


# Serial vs. parallel processes

## OLD: Serial

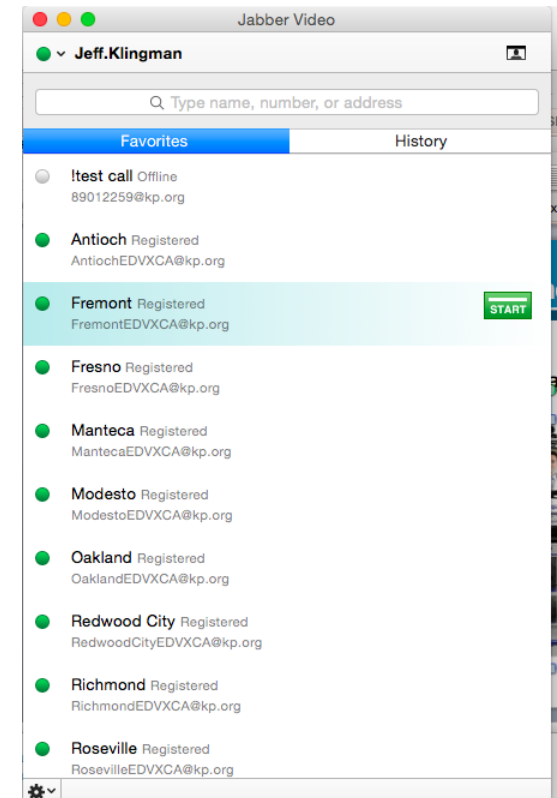


## NEW: Parallel



# Tele-technology needs for stroke

- Instant on
- Neurologist control of pan, scan, and zoom
- Good sound
- Mobile





# Teleneurology “Hub”

- Small core group of stroke specialist neurologists who are involved in all stroke alerts
- Remote exam by teleneurologists with RN / ED MD assistance
- Active 7am – midnight 7 days a week (rate very low in “off” hours)
- Neurologist orders the alteplase



# Step One: Rapid assessment on arrival with video



- Call to Neurologist via central 800 number - neurologist activates tele-presence unit
- Clinical assessment and exam by stroke neurologist by video
- Clinical assessment by ED physician
- IV access
- Lab
  - Blood sugar testing
  - INR if on warfarin
- Discussion of alteplase / CTA risks, benefits, alternatives
- IV alteplase mixing ordered as soon as possible (allows time for mixing)
- Call on / off stroke alert based on clinical assessment
- Checklist / time out before leaving for CT

# Step 2: Direct to CT/CTA after tPA is determined appropriate

- **Direct to CT scanner –**
  - **Cart and teleneuro goes to CT**
- **Alteplase in CT scanner if no CT contraindication**
  - **Second exam, team safety checklist**
- **CTA completed directly after CT and Alteplase initiation**

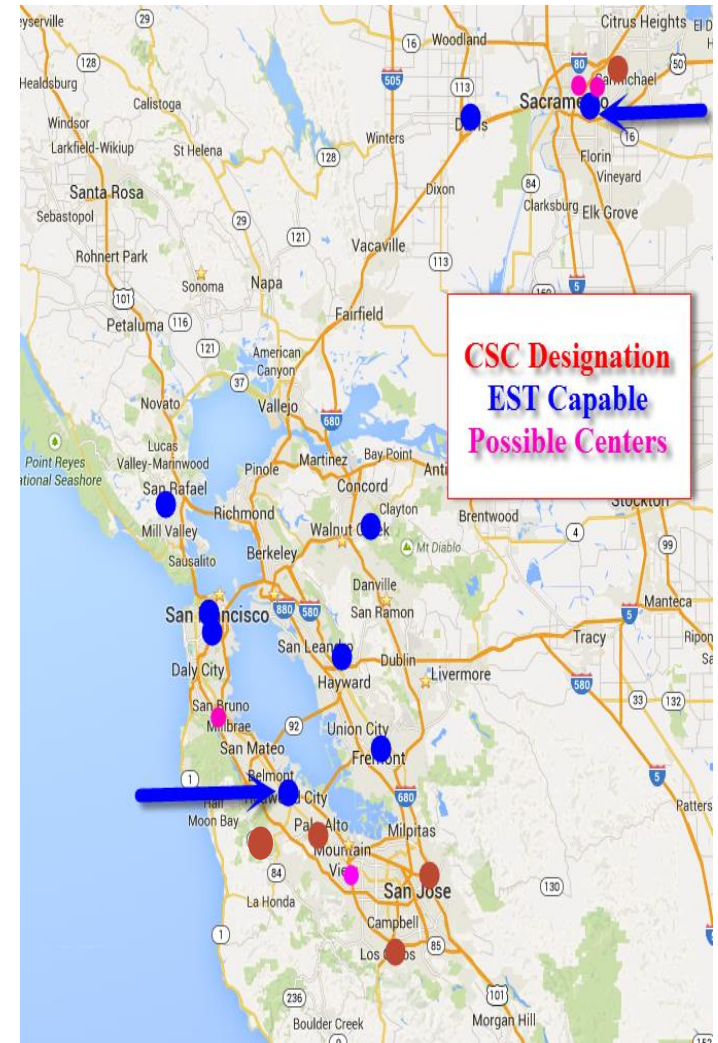


# Role of teleneurology in the process

- Initial history and exam
- Discussion of alteplase and CTA
- Orders alteplase mixing
- Agreement between ED doc and stroke neurologist
- CT done : read by neuroradiologist and teleneurologist
- Second exam, “enforces” team safety checklist
- Orders alteplase administration in CT scanner
- Stays on video while CTA
- Neuroradiology contacts teleneurologist with results
- Teleneurologists contacts receiving center MD if LVO

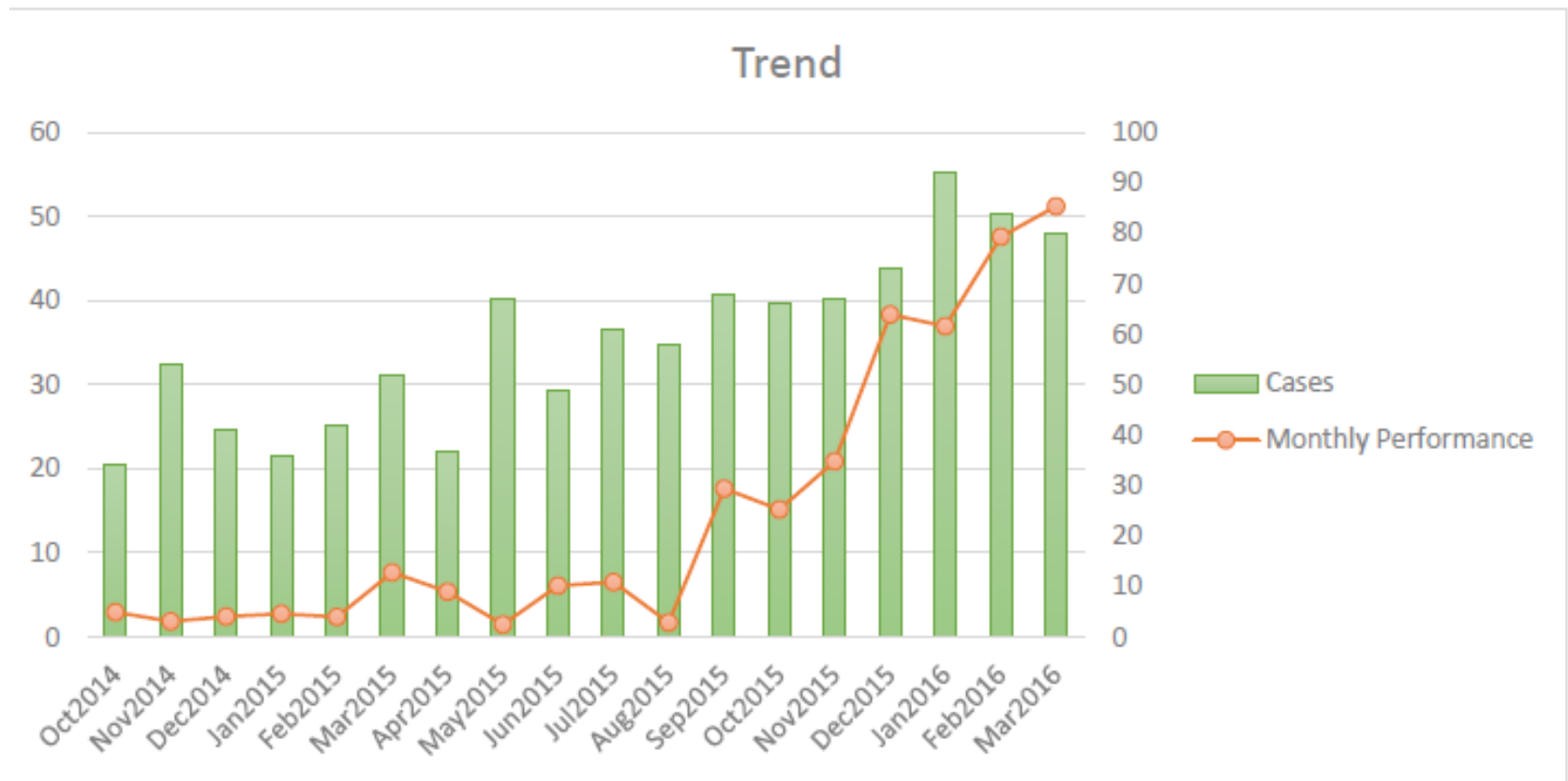
# Step 3: Rapid transfer

- Identification of preferred endovascular centers and contacts
  - One call system
  - Imaging access
  - Direct to cath lab
- Ambulance transfer hub contacted upon ordering of t-PA
  - LVO likely: order ambulance
  - LVO not so likely: notify
    - LVO identified : keep coming
    - LVO ruled out : never mind
- Ongoing time and outcome tracking

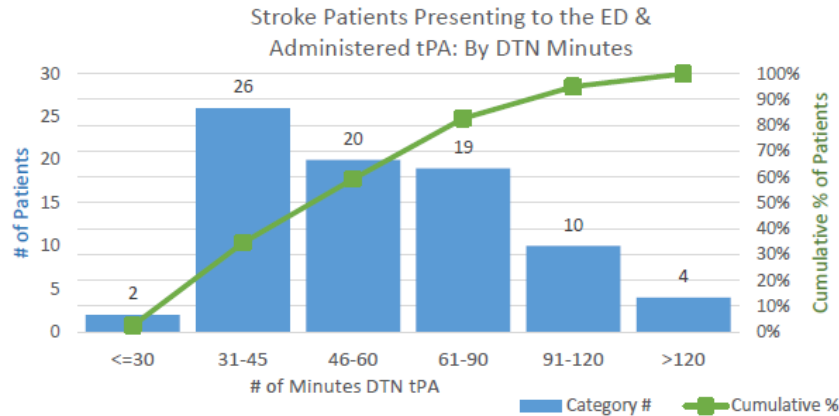


# Early Results

% DTN in < 30 minutes



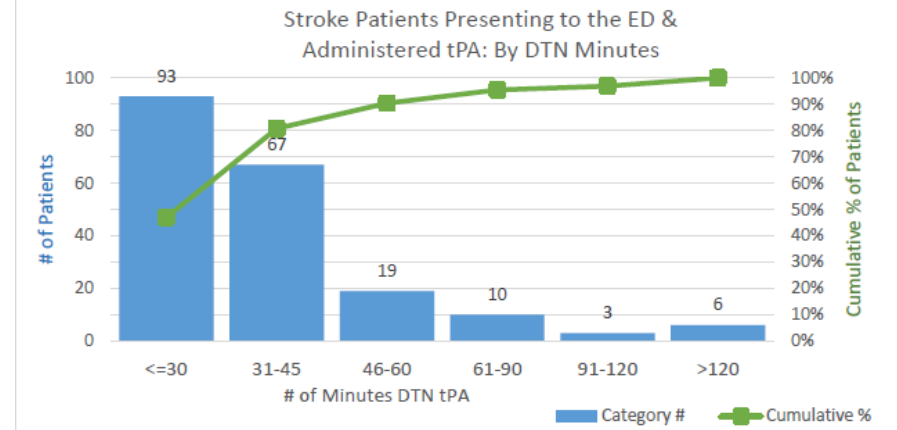
# Results: All Facilities



First quarter 2015

Median = 54 minutes,  
3% < 30 minutes

38 cases per month

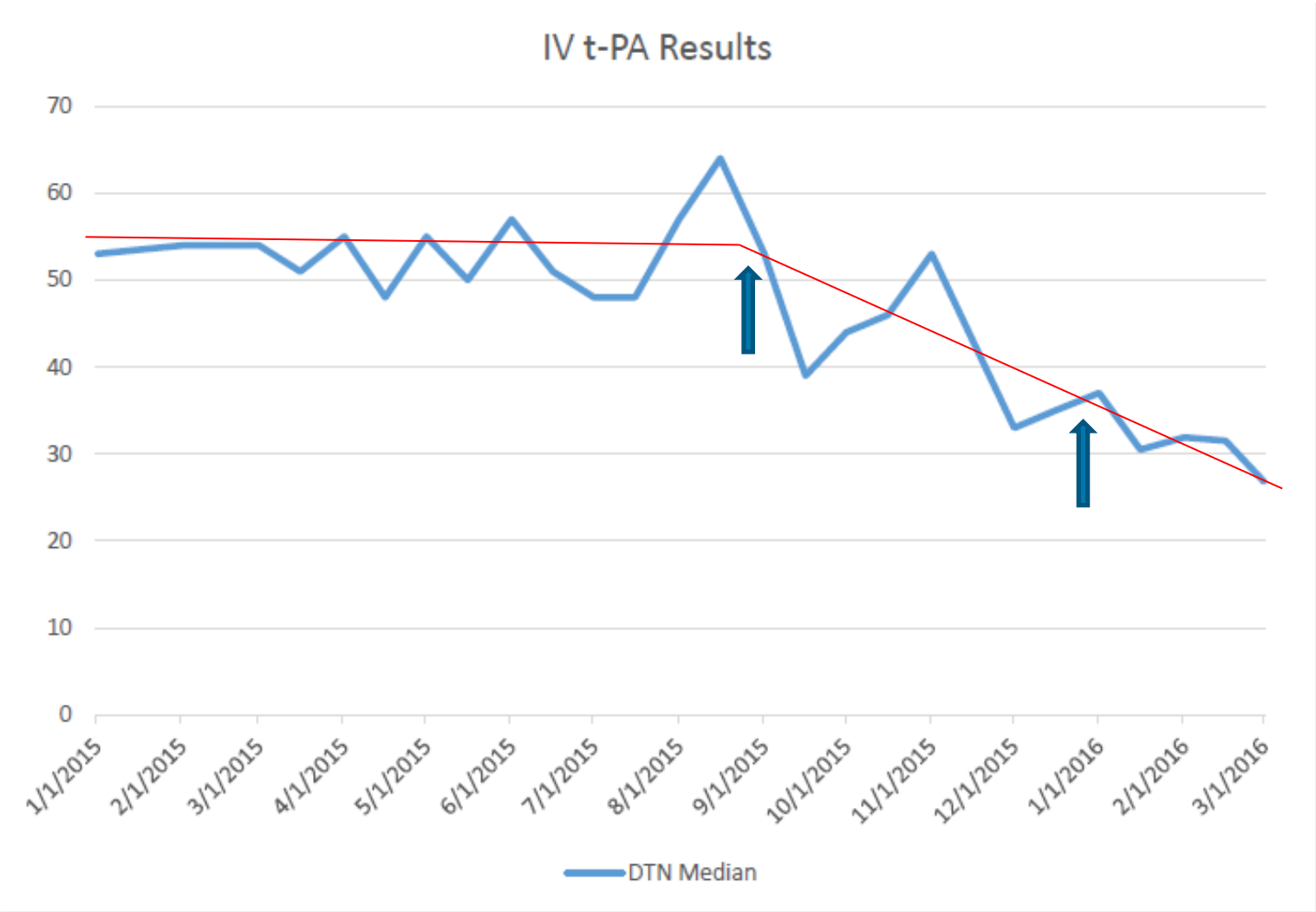


First quarter 2016

Median = 32 minutes,  
45% < 30 minutes

80 cases per month

# Results: All Facilities Median DTN





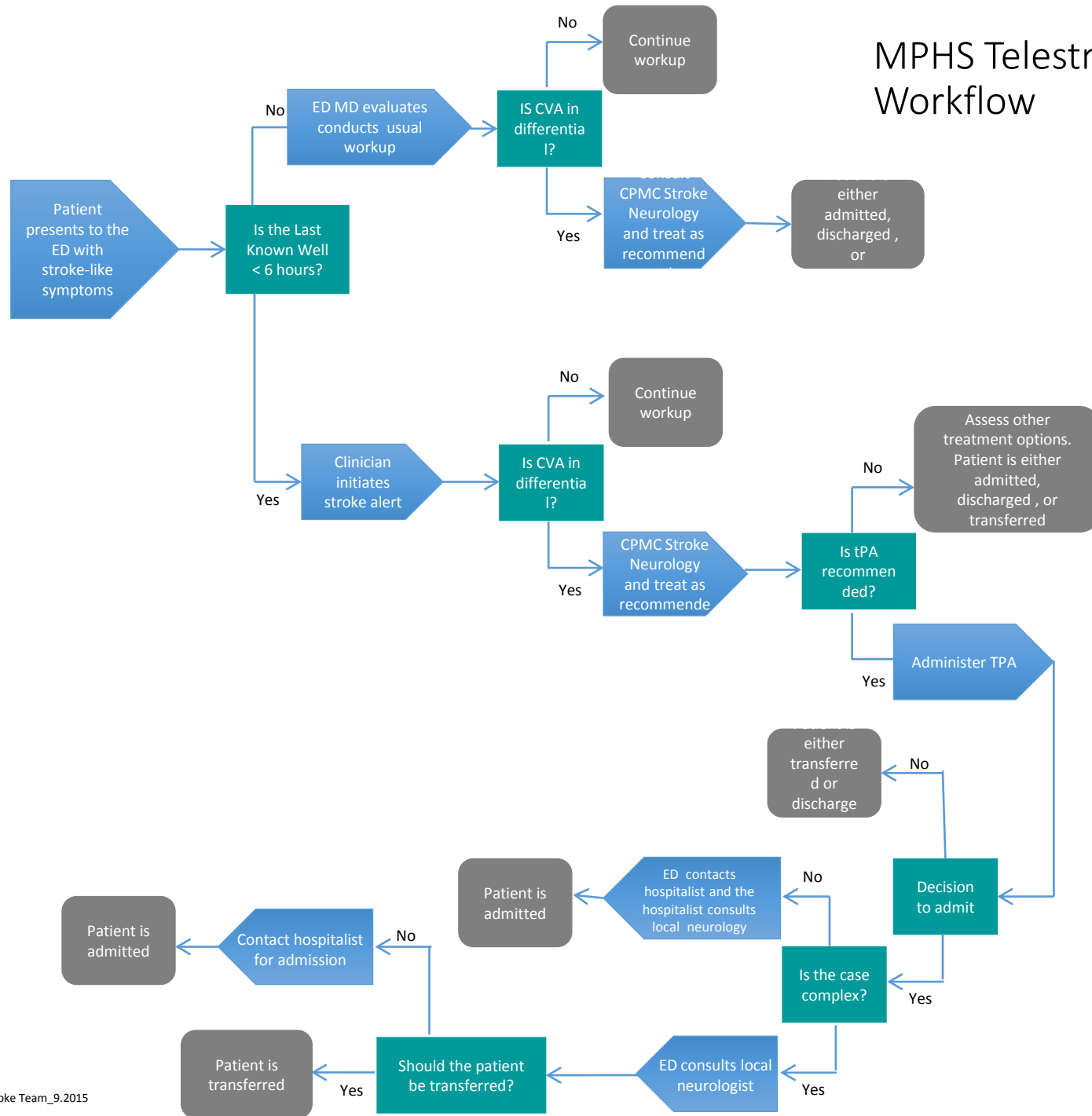
# Complications?

- 2014 symptomatic bleed rate : 4.5%
- 2016 symptomatic bleed rate: 4.3%
  - Rate without EST  $5/216 = 2.3\%$
  - Bleed with death no EST = 0.4% (non KP EXPRESS)

# On behalf of the KPNC Stroke FORCE (Fast Operating Remote Cerebrovascular Experts)



# MPHS Telestroke and ED Workflow



# Tele Medicine Program Timeline

2015	June	July	Aug	Sept	Oct	Nov
Tele medicine Decision	Discussions with local Neurologist , Telemedicine and Administration					
Privileges and credentialing		Application process for 7 stroke neurologists				★
Contract and Equipment			Tele medicine contract agreement, equipment delivery and testing			
Workflows		ED, Stroke Neurology, Community Neurology, Radiology and Hospitalist workflow				
Marketing and Communications			Physician and Community Forums, Newsletters			
Policies				Tele Medicine Policy approval		
Department Education					Staff Training	

# Changing Contraindications for t-PA in Acute Stroke:

Review of 20 Years Since NINDS

Current Cardiology Reports (2015) 17:81

Sarah Parker ; Yasmin Ali

Collection on ***Stroke***

# Origin of Original Contraindications for IV t-PA

Taken directly from the inclusion and exclusion criteria used in the National Institute of Neurological Disorders and Stroke (NINDS) trial

## Why?

1. To reduce possible adverse events
2. To avoid including patients with stroke mimics in the study population

**Table 1** Contraindications compared to exclusion criteria

Contraindications	Exclusion criteria
Evidence of intracranial hemorrhage on pretreatment evaluation	Evidence of intracerebral hemorrhage on CT
Recent (within 3 months) intracranial or intraspinal surgery, serious head trauma, or previous stroke	Stroke or serious head trauma within the preceding 3 months
Recent major surgery, e.g., coronary artery bypass graft, obstetrical delivery, organ biopsy, previous puncture of noncompressible vessels <sup>a</sup>	Major surgery within 14 days
History of intracranial hemorrhage	History of intracranial hemorrhage
Uncontrolled hypertension at time of treatment (e.g., >185 mmHg systolic or >110 mmHg diastolic)	Systolic blood pressure >185 mmHg or diastolic blood pressure >110 mmHg
“The safety and efficacy of treatment with Activase in patients with minor neurological deficit or with rapidly improving symptoms prior to the start of Activase administration has not been evaluated. Therefore, treatment of patients with minor neurological deficit or with rapidly improving symptoms is not recommended”	Rapidly improving or minor symptoms
Suspicion of subarachnoid hemorrhage on pretreatment evaluation	Symptoms suggestive of subarachnoid hemorrhage
Active internal bleeding	Gastrointestinal hemorrhage or urinary tract hemorrhage within the previous 21 days
Recent major surgery, e.g., coronary artery bypass graft, obstetrical delivery, organ biopsy, previous puncture of noncompressible vessels <sup>a</sup>	Arterial puncture at a noncompressible site within the previous 7 days
Seizure at the onset of stroke	Seizure at the onset of stroke
Current use of oral anticoagulants (e.g., warfarin sodium) or an international normalized ratio (INR) >1.7 or prothrombin time (PT) >15 s	
Administration of heparin within 48 h preceding the onset of stroke and have an elevated activated partial thromboplastin time (aPTT) at presentation	On anticoagulants or had received heparin within the 48 h preceding the onset of stroke and had an elevated partial thromboplastin time
Current use of oral anticoagulants (e.g., warfarin sodium) or an INR >1.7 or PT >15 s	Prothrombin times >15 s
Platelet count <100,000/mm <sup>3</sup>	Platelet count <100,000/mm <sup>3</sup>
Due to the increased risk for misdiagnosis of acute ischemic stroke, special diligence is required in making this diagnosis in patient whose blood glucose values are (50 or >400 mg/dl) <sup>a</sup>	Glucose concentrations below 50 mg per dl or above 400 mg per dl
Uncontrolled hypertension at time of treatment (e.g., >185 mmHg systolic or >110 mmHg diastolic)	Aggressive treatment required to reduce their blood pressure to the specified limits
Intracranial neoplasm, arteriovenous malformation, or aneurysm	
Patients with severe neurological deficit (e.g., NIHSS >22) at presentation. There is an increased risk of intracranial hemorrhage in these patients <sup>a</sup>	
Patients with major early infarct signs on a computerized cranial tomography (CT) scan (e.g., substantial edema, mass effect, or midline shift) <sup>a</sup>	
Neither the incidence of intracranial hemorrhage nor the benefits of therapy are known in patients treated with Activase more than 3 h after the onset of symptoms. Therefore, treatment of patients with acute ischemic stroke more than 3 h after symptom onset is not recommended	Inclusion criteria—symptom onset within 3 h of treatment

# Comparison of Contraindications in t-PA 2015 Label and Previous t-PA Labeling

## t-PA Feb 2015 labeling

### General

- Active internal bleeding
- Recent intracranial or intraspinal surgery or serious head trauma
- Intracranial conditions that may increase the risk of bleeding
- Bleeding diathesis
- Current severe uncontrolled HTN

### Acute Ischemic Stroke

- Current intracranial hemorrhage
- Subarachnoid hemorrhage

## Previous t-PA labeling

- History of intracranial hemorrhage
- Suspicion of subarachnoid hemorrhage
- Active internal bleeding
- Recent intracranial or intraspinal surgery
- Significant head trauma or prior stroke in previous 3 months
- Intracranial neoplasm, arteriovenous malformation, or aneurysm
- Elevated blood pressure (SBP > 185 mmHg or DBP > 110 mmHg)
- Acute diathesis
- Seizure at onset of stroke

*All contraindications designed to eliminate stroke mimics have now been removed*



# What's new?

- Conditions which the medication had not been studied in are no longer automatically considered as contraindications
- Contraindications designed to eliminate stroke mimics have now been removed

## Activase Feb 2015 labeling

### General

- Active internal bleeding
- Recent intracranial or intraspinal surgery or serious head trauma
- Intracranial conditions that may increase the risk of bleeding
- Bleeding diathesis
- Current severe uncontrolled HTN

### Acute Ischemic Stroke

- Current intracranial hemorrhage
- Subarachnoid hemorrhage

## New revision to the saying...

*“absence of evidence is not evidence of absence”*



*“absence of evidence of a risk is not evidence of the risk”*

# Evidence: Use of IV t-PA in patients with contraindications

Study	Conclusion
Kvistad CE, Logallo N, Thomassen L, et al. Safety of off-label stroke treatment with tissue plasminogen activator. <i>Acta Neurol Scand.</i> 2013;128:48–53.	When compared to patients who did not have any contraindications to IV t-PA and received treatment, they found that there was no significant difference in the rate of symptomatic intracerebral hemorrhage (sICH).
Guillan M, Alonso-Canovas J, Carcia-Caldentey V, et al. Off-label intravenous thrombolysis in acute stroke. <i>Eur J Neurol.</i> 2012;19: 390–4.	No difference in the rates of sICH or severe systemic bleeding
Nadeau JO, Shi S, Fang J, et al. tPA use for stroke in the registry of the Canadian stroke network. <i>Can J Neurol Sci.</i> 2005;32: 433–9.	Patients who had contraindications did not have higher rates of sICH or mortality
Frank B, Grotta JC, Alexandrov AV, et al. Thrombolysis in stroke despite contraindications or warnings? <i>Stroke.</i> 2013;44:727–33	When compared to patients who did not receive IV t-PA, patients with age >80, history of previous stroke and diabetes, and NIHSS score >22 had better outcome at 3 months

# **Evidence: Use of IV t-PA in mild or rapidly improving symptoms**

Study	Conclusion
Rajajee V, Kidwell C, Starkman S, et al. Early MRI and outcomes of untreated patients with mild or improving ischemic stroke. <i>Neurology</i> . 2006;67:980–4.	Patients who did not receive IV t-PA due to mild or rapidly improving symptoms had poorer outcomes compared to those who received IV t-PA
Smith EE, Abdullah AR, Petkovska I, et al. Poor outcomes in patients who do not receive intravenous tissue plasminogen activator because of mild or improving ischemic stroke. <i>Stroke</i> . 2005;36:2497–9.	Patients who did not receive IV t-PA due to mild or rapidly improving symptoms were not able to be discharged home due to their deficits compared to those who received IV t-PA
Smith EE, Fonarow GC, Reeves MJ, et al. Outcomes in mild or rapidly improving stroke not treated with intravenous recombinant tissue-type plasminogen activator. <i>Stroke</i> . 2011;42:3110–5	
Baumann CR, Baumgartner RW, Gandjour J, et al. Good outcomes in ischemic stroke patients treated with intravenous thrombolysis despite regressing neurological symptoms. <i>Stroke</i> . 2006;37:1332–3.	Patients who received IV t-PA for strokes with mild or rapidly improving symptoms did not experience sICH

# **Evidence**: Use of IV t-PA in patients with recent ischemic stroke

Study	Conclusion
Alhazzaa M, Sharma M, Blacquiere D, et al. Thrombolysis despite recent stroke. Stroke. 2013;44:1736–8	Patients who had a previous stroke within 3 months of receiving IV t-PA did not experience sICH.
Meretoja A, Putaala J, Tatlisumak T, et al. Off-label thrombolysis is not associated with poor outcome in patients with stroke. Stroke. 2010;41:1450–8	

# Conclusion

- Original IV t-PA contraindications were largely based on inclusion and exclusion criteria used in the NINDS trial
- Latest contraindication revisions (Feb 2015) will increase the number of patient eligibility for treatment
- As always, there is no substitute for clinical judgment