

Stroke protocol in the emergency department

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BOARD CERTIFIED: EMERGENCY MEDICINE AND INTERNAL MEDICINE

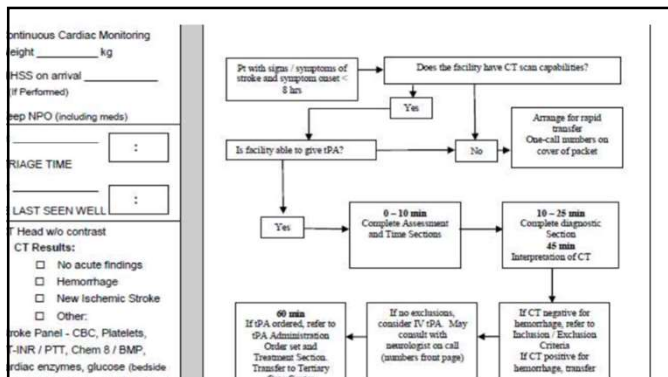
- No financial disclosures
- No off label discussions

Is Stroke on the Differential???

- Weakness
- Dizziness
- Numbness
- Confusion
- Sleepy
- Just Not Right
- Facial droop
- Difficulty speaking

How high is Stroke on the differential???

- Stroke
- Sepsis
- Hypoglycemia
- Urinary Tract Infection
- Pneumonia
- MI
- CHF



Key to making this work

- High Suspicion
- Good Process (that can be started by any team member)

Patients Arrive by one of two mechanisms

- By Ambulance
- By Private Vehicle

Important Information from the Ambulance

- EMS providers suspicion of Stroke
- Onset of Symptoms
- Cincinnati Stroke Scale (FAST)
- Current Medications (especially anticoagulants)

The proof is in the Process

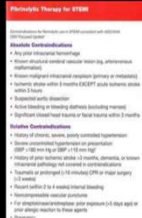
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- Process centered around must have information
- Variable outcome (ie times) indicates inconsistent Process
- Mixed messages
- Educate understanding

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[illegible]

Refining the Process

- Activate Stroke Code based on EMS information
- Do not off load the Patient in the ED (unless hemodynamic or respiratory instability)

- Maybe draw blood or get vitals or Do that in CT
- Off load from the ambulance cart to CT table

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Neurologic Therapies for MS

Indications for Natalizumab use in MS (approved with REMS)
 1/1/2006/2014

- Approved Indications:**
 - Any other relapsing remitting
 - Remove structural central vascular disease, arteriovenous malformations
 - Chronic multiple-sclerotic lesions (garrys) or extensive
 - Acute relapse after 1 month's EXCEPT acute isolated optic
 - Suffered a relapse
- Approved in bleeding disorders involving meninges**
- Approved in relapsing or acute relapse after 2 months**

Relative Contraindications

- History of chronic, severe, poorly controlled hypertension
- Severe uncontrolled hypertension or presentation
- Active TB or TB in 12 months prior to treatment
- History of prior stroke/aphasia > 6 months, or known
- History of stroke/aphasia < 6 months or contraindications
- Trauma or prolonged > 12 months CPR or major surgery > 12 months
- History of TB > 4 weeks from treatment
- Nonsteroid/steroid inhibitor proteins
- For symptomatic treatment prior exposure 10 days prior or 10 days before these agents
- Pregnancy
- Active hepatitis A
- Current use of alcohol/drugs, the higher the MS, the higher the risk of bleeding

Design orders to accomplish the task

- CT
- Labs
- Hypertension Control
- TPA
- Nursing Orders

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Goals of Triage? (Trinity P & P)

- Rapid identification of patients with urgent, life threatening conditions.
- Quick sorting and determination of most appropriate treatment area
- Decrease Congestion of emergency department waiting
- Provide ongoing assessment of each patient
- Provide information to patients and families regarding care and waiting times
- Contribute information that helps to define departmental acuity

<https://www.esitriage.com/esi-algorithm>

You take a deep breath...Now what

- | | |
|---|---|
| <ul style="list-style-type: none"> • Back from CT • Orders entered • Blood in Lab • Pharmacy alerted • EMS alerted | <ul style="list-style-type: none"> • All of the details you rushed through. <ul style="list-style-type: none"> • Complete history and physical including detailed neurologic exam. • Review of Medications • Review of contraindications. • Discussion of Risk and benefits • Consult with Neurologist |
|---|---|

Date: 9/8/16 Referring Agency/Facility: New Town EMS/No Star
 Last Known Well: 1720 Patient arrival time: 1844
 Stroke Alert called: 1825 Patient's FIN: # 165202580

Stroke Alert Metric	Goal	Actual	Met/Not Met
DOOR TO MD EVALUATION	10 minutes	0 Minutes	Met
DOOR TO CT SCAN	25 minutes	13 Minutes	Met
CT SCAN TO RESULTS	20 minutes	31 Minutes	Not Met
DOOR TO LAB RESULTS	45 minutes	PTA	
DOOR TO MEDICATION ORDER		48 Minutes	
DOOR TO NEEDLE	60 minutes	57 Minutes	Met

Staff involved:
 EEC: Dr. Talley, Patti H. RN
 NEUROLOGIST: Dr. Kordlar

Comments:
 Patient arrived via Northstar from New Town; he was quickly evaluated and sent to CT. This was negative and he was a candidate for thrombolytics. The patient was not sure if he wanted to receive the medication, so there was a slight delay in giving him the medication based on getting his consent. He did receive it within the 60 minute time frame. Great job!

Is This a Stroke?

- Focal Neurological symptoms
 - Acute onset
- Differentials?
 - Stroke/TIA. Seizure. Migraine equivalent. Hypoglycemia. Psychogenic. Mass lesion. Delirium.....
 - When main symptom is Encephalopathy, very difficult to ascertain.
 - Is there focal findings? Insulin use? Epilepsy? Drug use? Trauma?
- Confusing symptoms.
 - Crossed findings in the brainstem
 - Total facial paralysis
 - Brainstem symptoms not well represented on stroke scale
- ABC's are always initial Assessment (ER Team)
- STAT labs and EKG
 - Discuss later that most labs should not delay administration of TPA

TPA considerations

- Last Known Well
 - May not be able to determine exact time of onset
 - Very crucial
 - Largely determines whether or not Alteplase candidate
 - Within 3 hours vs the 3-4.5 hour time window
 - Consideration for Neuro Intervention
 - Many different ways to figure out times (cell phones, TV shows.....)

Consideration Cont.

- Need to know BP
 - If from outside hospital, this could be treated early and hopefully stable within goal by the time arrived at receiving facility
- Medication List
- History of Diabetes and/or Stroke
- Head CT early
 - If signs of hemorrhage, not a candidate for further stroke intervention
 - Look for evidence of extensive stroke, mild early changes, or dense artery sign



Hour Time Window

- < 3 hours
 - Age 18 or higher

Exclusion criteria
Medical
Significant stroke or head trauma in the previous three months
Previous intracranial hemorrhage
Intracranial neoplasms, arteriovenous malformations, or aneurysms
Recent intracranial or intraspinal surgery
Intracranial puncture at a noncompressible site in the previous seven days
Clinical
Symptoms suggestive of subarachnoid hemorrhage
Persistent blood pressure elevation (systolic ≥ 185 mmHg or diastolic ≥ 110 mmHg)
Serum glucose < 50 mg/dL (< 2.8 mmol/L)
Active intracranial bleeding
Acute bleeding diathesis, including but not limited to conditions defined in "Hematologic"
Hematologic
Platelet count $< 100,000/\text{mm}^3$
Current anticoagulant use with an INR > 1.7 or PT > 1.5 seconds*
Insuppressible urine within 48 hours and an abnormally elevated aPTT*
Current use of a direct thrombin inhibitor or direct factor Xa inhibitor with evidence of anticoagulant effect by laboratory tests such as aPTT, INR, FCL, TT, or appropriate factor Xa activity assays
Head CT scan
Evidence of hemorrhage

3 Hours continued

Relative exclusion criteria¹

Only minor and isolated neurologic signs
Rapidly improving stroke symptoms
Major surgery or serious trauma in the previous 14 days
Gastrointestinal or urinary tract bleeding in the previous 21 days
Myocardial infarction in the previous three months
Seizure at the onset of stroke with postictal neurologic impairments
Pregnancy

- Many of these, TPA would be considered by many providers.
 - Risk – Benefit ratio
 - If deficit is persistent and debilitating – consensus to treat
 - Hemianopia
 - Aphasia
 - Visual or sensory extinction
 - Weakness limiting gravity effort
 - Any deficits considered potentially disabling

3-4.5 Hours

- All exclusion criteria noted earlier for < 3 hours, PLUS....
 - Age > 80
 - Oral Anticoagulant use regardless of INR
 - Severe stroke (NIHSS > 25)
 - Combination of both prior clinical stroke and diabetes

Timing of TPA

Improving timing

- Accurate weight (bed scale, weigh bed/patient together.....)
- Head CT immediately on any potential code stroke
- STAT labs
- Finger stick for glucose
- Frequent BP monitoring

Lab work: Only need to know glucose prior to TPA unless....

- history of bleeding or on anticoagulation
- If history of thrombocytopenia or bleeding abnormality
- Anticoagulant/Medication list is not known
- Many places would order/start Alteplase while waiting for labs
 - Consider stopping depending on laboratory abnormalities

Use of newer Anticoagulants

- TPA generally not recommended unless have not taken in 24-48 hours

Delays in Treatment

- Most delay is prior to any hospital
 - Live alone, go to PCP, talk with family members
 - Feel they can "sleep it off".....
 - 911!!!!!! Is always the best course of action
- Head CT
 - Biggest delay in hospital
 - Immediately to head CT
 - Conversations with interpreting radiologist or stroke neurologist personal interpretation
- Goal is < 60 minutes door to needle
 - Alteplase at bedside
 - Not waiting on coag tests
 - If stroke physician comfortable reading head CT
 - Do not need written consent
 - Telemedicine – stroke neurologist immediately available

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NIH Stroke Scale

1a. Level of consciousness: The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, endotracheal trauma/handcuffs. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.	0 = Alert; keenly responsive. 1 = Not alert; but arousable by minor stimulation to obey, answer, or respond. 2 = Not alert; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped). 3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, and areflexic.	1c. LOC commands: The patient is asked to open and close the eyes and then to grip and release the non-parietic hand. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to him or her (pantomime), and the result scored (ie, follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.	0 = Performs both tasks correctly. 1 = Performs one task correctly. 2 = Performs neither task correctly.
1b. LOC questions: The patient is asked the month and higher age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues.	0 = Answers both questions correctly. 1 = Answers one question correctly. 2 = Answers neither question correctly.		

NIHSS

3. Best gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculcephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive efforts, the score will be 3. If a patient has an isolated peripheral nerve palsy (CN III, IV or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.

0 = **Normal.**
1 = **Partial gaze palsy;** gaze is abnormal in one or both eyes, but forced deviation or total gaze palsy is not present.
2 = **Forced deviation,** or total gaze palsy not overcome by the oculcephalic maneuver.

3. Visual: Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat, as appropriate. Patients may be encouraged, but if they look at the side of the moving finger appropriately, this can be scored as normal. If there is unilateral blindness or emusication, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11.

0 = **No visual loss.**
1 = **Partial hemianopia.**
2 = **Complete hemianopia.**
3 = **Bilateral hemianopia** (blind including cortical blindness).

4. Facial palsy: Ask - or use pantomime to encourage - the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barriers obscure the face, these should be removed to the extent possible.

0 = **Normal** symmetrical movements.
1 = **Minor paralysis** (flattened nasolabial fold, asymmetry on smiling).
2 = **Partial paralysis** (total or near-total paralysis of lower face).
3 = **Complete paralysis** of one or both sides (absence of facial movement in the upper and lower face).

NIHSS

5. Motor arm: The limb is placed in the appropriate position: extend the arm (palms down) 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-parietic arm. Only in the case of amputation or joint fusion at the shoulder, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

0 = **No drift;** limb holds 90 (or 45) degrees for full 10 seconds.
1 = **Drift;** limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support.
2 = **Some effort against gravity;** limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity.
3 = **No effort against gravity;** limb falls.
4 = **No movement.**
UN = **Amputation** or joint fusion, explain: _____
5a. **Left arm**
5b. **Right arm**

6. Motor leg: The limb is placed in the appropriate position: hold the leg at 30 degrees (always tested supine). Drift is scored if the leg falls before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-parietic leg. Only in the case of amputation or joint fusion at the hip, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

0 = **No drift;** leg holds 30-degree position for full 5 seconds.
1 = **Drift;** leg falls by the end of the 5-second period but does not hit bed.
2 = **Some effort against gravity;** leg falls to bed by 5 seconds, but has some effort against gravity.
3 = **No effort against gravity;** leg falls to bed immediately.
4 = **No movement.**
UN = **Amputation** or joint fusion, explain: _____
6a. **Left leg**

NIHSS

7. Limb ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position.

0 = **Absent.**
1 = **Present in one limb.**
2 = **Present in two limbs.**
UN = **Amputation** or joint fusion, explain: _____

8. Sensory: Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas (arms [not hands], legs, trunk, face) as needed to accurately check for hemispheric loss. A score of 1, "severe or total sensory loss," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 3. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 2a=3) are automatically given a 2 on this item.

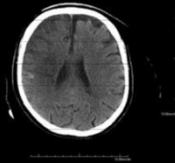
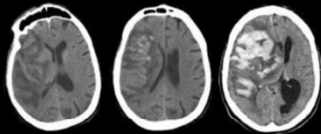
0 = **Normal;** no sensory loss.
1 = **Mild to moderate sensory loss;** patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched.
2 = **Severe to total sensory loss;** patient is not aware of being touched in the face, arm, and leg.

Acute Treatment

- If patient's eligible and agreeable, treatment with IV Alteplase recommended
 - Informed consent.....
 - Within 3 hours = Grade 1A evidence. 3-4.5 hours = Grade 2A evidence
- Dosage = 0.9 mg/kg (actual body weight) with a max dose of 90 mg.
 - 10% as bolus over 1 minute, remaining 90% over one hour
 - Accurate weight important
- Withhold Alteplase if CT shows extensive multilobar hypodensity with > 33% of hemisphere.
 - Minor ischemic changes is NOT a contraindication (subtle or small hypodensity, loss of gray-white distinction, hyperdense artery sign, obscuration of lentiform nucleus)
- Time is brain – sooner the treatment the better
- Strict BP control
 - At or below 185/110 prior to administration
 - At or below 180/105 for 24 hours post TPA

TPA complications

- ICH
 - 5-7% for symptomatic ICH
 - Symptomatic?
 - Neurological worsening. Mostly 4 or more points on the NIHSS.
 - Would not count small petechial hemorrhages
 - No statistically significant change in mortality



Complications Cont.

- Systemic Bleeding
 - Oozing for catheter, ecchymosis around BP Cuff, gum bleeding, subconjunctival.....
 - Rarely have to discontinue
 - If serious bleeding GI, GU, Pericardial (MI)
 - If hypotension after TPA consider echo to r/o pericardial bleed
- Angioedema
 - 1-8%
 - Mild and transient
 - On affected side of body (opposite side of stroke)

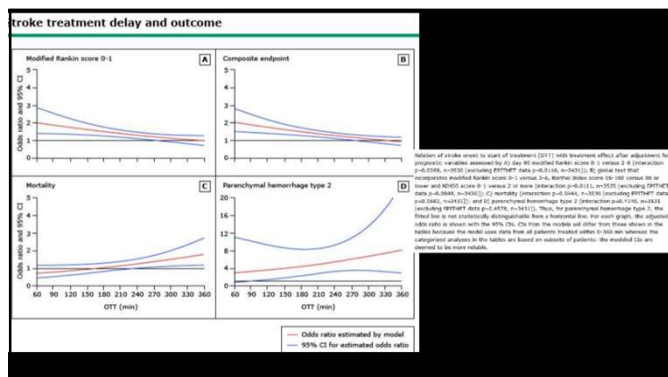


Outcomes

- Time is brain
 - Benefit of intravenous thrombolysis decreases continuously over time from symptom onset
- Outcome with pooled data
 - Many trials (NINDS, ATLANTIS, ECASS 1, 2, 3, EPITHET and IST-3)
 - Primary outcome largely proportion achieving good outcome at 3-6 months determined by modified Rankin scale of 0 or 1.
 - Within 3 hours – good outcome 33% vs 23% for control
 - 3-4.5 hours – 35% vs 30 %
 - Alteplase beneficial regardless of patient age, stroke severity, or the associated increased risk of symptomatic or fatal intracranial hemorrhage in the first days after Alteplase treatment

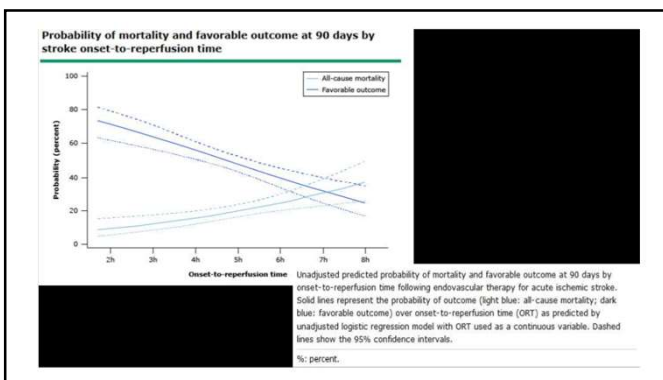
Modified Rankin scale

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without as
5	Severe disability; bedridden, incontinent, and requiring constant nursing care and attention
6	Dead



Mechanical Thrombectomy

- Consideration for patients when groin puncture can be obtained within 6 hours of last known normal and NIHSS 6 or greater
 - Most likely to have large vessel occlusion
 - Many would consider with lower scale depending on age and deficits
- Can also be considered for patient's who are not Alteplase candidates for whatever reason
- Many recent trials supporting this
 - SWIFT PRIME, ESCAPE, MR CLEAN, EXTEND-IA, REVASCAT
- Should receive Alteplase without delay even if thrombectomy considered early on (i.e. dense artery sign).
- Again Time is Brain



Wake Up Strokes

- Active Trials (MR Witness.....)
- No RCT's for Alteplase in these situations
 - Unable to provide evidence based treatments
- Currently most institutions would not recommend Alteplase in these situations unless LKW was within appropriate time windows
 - Many places considering neuro IR procedures depending on advanced imaging
 - Rapid MRI (diffusion, FLAIR, MRA TOF) or CTA/MRI or MR/CT perfusion
 - If evidence for penumbra and large vessel occlusion – consideration

Acronym	Study Population	Investigational Treatment	Comparator	Imaging Concept	Imaging Exclusion Criteria	Planned Sample Size
DAWN	Late onset stroke incl. unknown time of symptom onset	Endovascular (Two thrombectomy procedures)/IV tPA	Standard of care	Proximal occlusion; clinical-imaging mismatch; high NIHSS score with small DWI/CTP/CTBF lesion	Large ischemic lesion >1/3 MCA	500
ECASS-4/EXTEND	Stroke onset 4.5-9 h incl. unknown time of symptom onset	IV tPA (Alteplase 0.9 mg/kg)	Placebo	Penumbra: MRI	DWI lesion >1/3 MCA >100 mL	264
THAWES ⁴⁵	Unknown time of symptom onset	IV tPA (Alteplase 0.6 mg/kg)	Placebo	Estimation of lesion age: DWI-FLAIR mismatch	DWI ASPECTS <5	300
WAKE-UP ⁴⁶	Unknown time of symptom onset	IV tPA (Alteplase 0.9 mg/kg)	Placebo	Estimation of lesion age: DWI-FLAIR mismatch	DWI lesion >1/3 MCA >100 mL	800

EXTEND ³⁴	Stroke onset 4.5-9 h incl. unknown time of symptom onset	IV tPA (Alteplase 0.9 or 0.6 mg/kg)	Placebo	Penumbra: MRI or CTP	Infarct core >1/3 MCA >70 mL	400
MR WITNESS	Unknown time of symptom onset	IV tPA (Alteplase 0.9 mg/kg)	n.a.	Estimation of lesion age: DWI-FLAIR mismatch	>10 microbleeds	80
NORTEST ³⁹	Eligible for IV tPA+subgroup <4.5 h after symptom recognition	Intravenous TNK 0.4 mg/kg	IV tPA (Alteplase 0.9 mg/kg)	For wake-up stroke: estimation of lesion age: DWI-FLAIR mismatch	n.a.	954
POSITIVE	Stroke onset <12 h incl. unknown time of symptom	Endovascular (aspiration, stent retriever)	Standard of care	Proximal occlusion; penumbra: MRI or CTP	Infarct on CT >1/3 MCA or ASPECTS	750

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