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CDU Curriculum: TIA

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Epidemiology

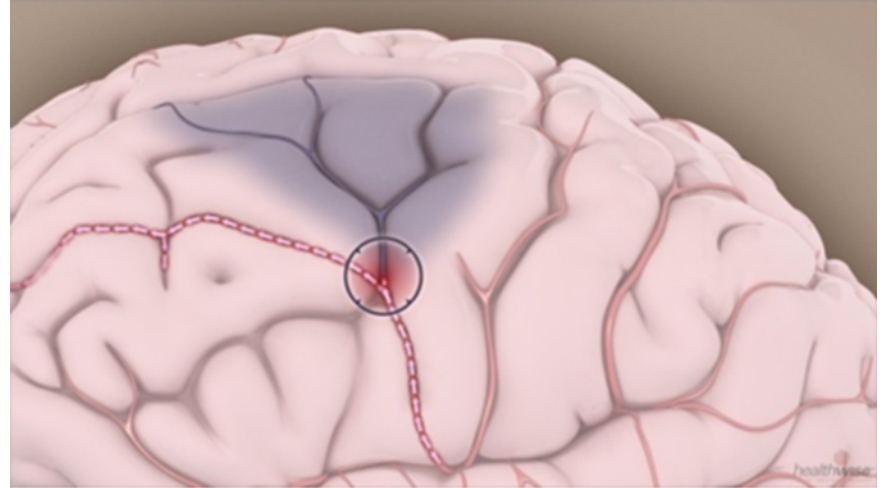
- 200,000 to 500,000 TIAs per year in the US
- In about 10% of TIA patients, the patient will go on to have a stroke within 90 days, with highest risk in first 48 hours
- 610,000 ischemic strokes occur per year in US
- Ischemic stroke has an in-hospital mortality rate of 5-10%
- 87% of strokes are ischemic
- Advanced neuroimaging has shown that many clinically diagnosed TIAs actually represent small infarctions with resolution of symptoms

TIA Defined

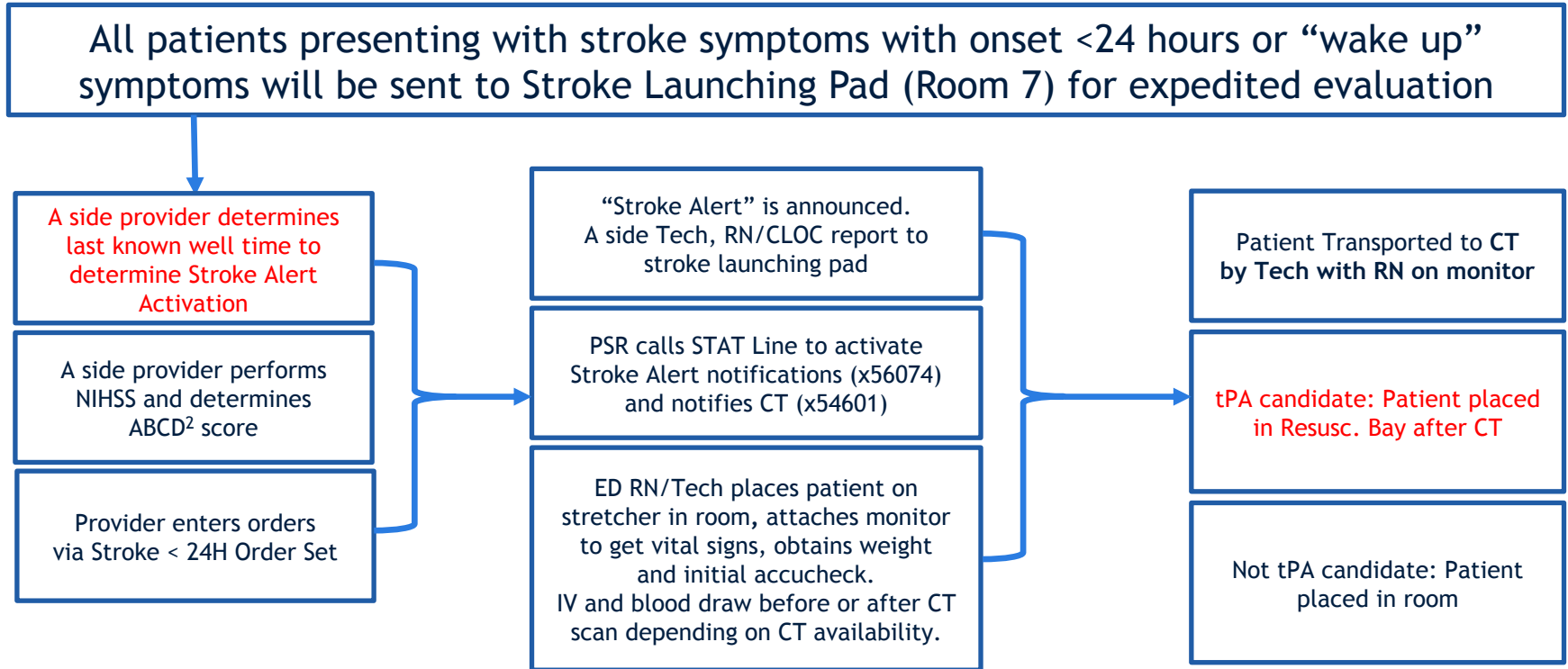
- Mid 1960s: sudden onset of a focal neurologic symptom and/or sign lasting less than 24 hours and caused by reversible cerebral ischemia
- 2002: a transient episode of neurologic dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction

TIA Pathophysiology

- Like stroke, cause of ischemia can be atherothrombotic, embolic, lipohyalinosis, small arterial dissections, etc.
 - By definition there is no infarction



ED Stroke Alert Activation Process



Emergency Department Management = Stroke Alert vs TIA?

- NIHSS guides decision for tPA administration
- RACE score/BE FAST to evaluate for possible large vessel occlusion (LVO)
- Keep a broad differential and consider stroke mimics
- ABCD² score for CDU appropriateness

Medscape www.medscape.com

| Category | Score/Description | | Date/Time | Date/Time | Date/Time | Date/Time | Date/Time |
|---|--|---------|-----------|-----------|-----------|-----------|-----------|
| | | | Initials | Initials | Initials | Initials | Initials |
| 1a. Level of Consciousness (Alert, drowsy, etc.) | 0 = Alert 1 = Drowsy 2 = Stuporous 3 = Coma | | | | | | |
| 1b. LOC Questions (Name, age) | 0 = Answers both correctly 1 = Answers one correctly 2 = Incorrect | | | | | | |
| 1c. LOC Commands (Open/close eyes, make fist/leg 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 = Fixed 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 (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 = Unreliable (Joint fixation or limb amput) | 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 = Unreliable (Joint fixation or limb amput) | Right | | | | | |
| 6a. Motor Leg - Left (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 = Unreliable (Joint fixation or limb amput) | 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 = Unreliable (Joint fixation or limb amput) | 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 unintelligible or worse X = Intubated or other physical barrier | | | | | | |
| 11. Extinction and Inattention (Use information from prior testing to identify neglect or double amputaneous stimuli testing) | 0 = No neglect 1 = Partial neglect 2 = Complete neglect | | | | | | |
| TOTAL SCORE | | | | | | | |
| INITIAL | SIGNATURE | INITIAL | SIGNATURE | INITIAL | SIGNATURE | INITIAL | SIGNATURE |
| | | | | | | | |

Source: J Neurosci Nurs © 2006 American Association of Neuroscience Nurses

Orders for evaluation for Acute Stroke < 24 hours

Nursing and Labs

Vital Signs: Per Unit Policy

P Per Unit Policy, starting today at 0909, Until Specified

Cardiac Monitoring ED Only

Ongoing, starting today at 0909, Until Specified, STAT

Pulse Oximetry Continuous Notify provider if pulse ox less than: 92 %

Continuous, starting today at 0909, Until Specified, STAT

Notify provider if pulse ox less than: 92 %

Dysphagia Screen Assessment

Once, First occurrence today at 0909, STAT

POCT Glucose

P STAT, First occurrence today at 0909, Routine

NPO No meds: Strict NPO

Diet effective now, starting today at 0909, Until Specified

Specify: No meds

With: Strict NPO

Basic Metabolic Panel

W Add to specimen collected 6d ago?

P STAT, First occurrence today at 0909

New collection, Blood, Venous

Complete Blood Count (CBC) and Differential

STAT, First occurrence today at 0909

Blood, Venous

Creatinine, Whole Blood

STAT, First occurrence today at 0909

Blood, Venous

Prothrombin Time (PT) and INR

STAT, First occurrence today at 0909

Partial Thromboplastin Time (PTT)

STAT, First occurrence today at 0909

Blood, Venous

Troponin T hs (Gen 5)

W Add to specimen collected 10h ago?

STAT, First occurrence today at 0909

New collection, Blood, Venous

Urinalysis

STAT, First occurrence today at 0909

Urine, Clean Catch

Imaging

! X-ray chest 1 view frontal

P STAT, Once, First occurrence today at 0909

Portable? Yes

Pager/phone for questions and results? 267-767-3625

Reason for Exam: TIA or CVA

CT brain stroke protocol

STAT, Once, First occurrence today at 0909

What is the patient's sedation requirement? No sedation

Does the patient weigh over 300lbs? No

Pager/phone for questions and results? 267-767-3625

#215-554-4172 : Contact Stroke Alert Phone for STAT Results as soon as possible, Reason for Exam: Stroke, follow up

! CT angiogram head neck with contrast

P STAT, Once, First occurrence today at 0909

Other pertinent clinical information? Stroke symptoms <24 hours

What is the patient's sedation requirement? No sedation

Is there a known history of diabetes, renal insufficiency, or kidney disease? Unable to determine

Has the patient had a Creatinine/GFR performed within the last 6 weeks? Unable to determine

Does the patient weigh over 300lbs? No

Pager/phone for questions and results? 267-767-3625

#215-554-4172 : Contact Stroke Alert Phone for STAT Results as soon as possible, Reason for Exam: Cerebral ischemia

! CT brain perfusion with contrast

P STAT, Once, First occurrence today at 0909

Other pertinent clinical information? stroke symptoms 6-24 hours concerning for LVO

What is the patient's sedation requirement? No sedation

Is there a known history of diabetes, renal insufficiency, or kidney disease? Unable to determine

Has the patient had a Creatinine/GFR performed within the last 6 weeks? Unable to determine

Does the patient weigh over 300lbs? No

Pager/phone for questions and results? 267-767-3625

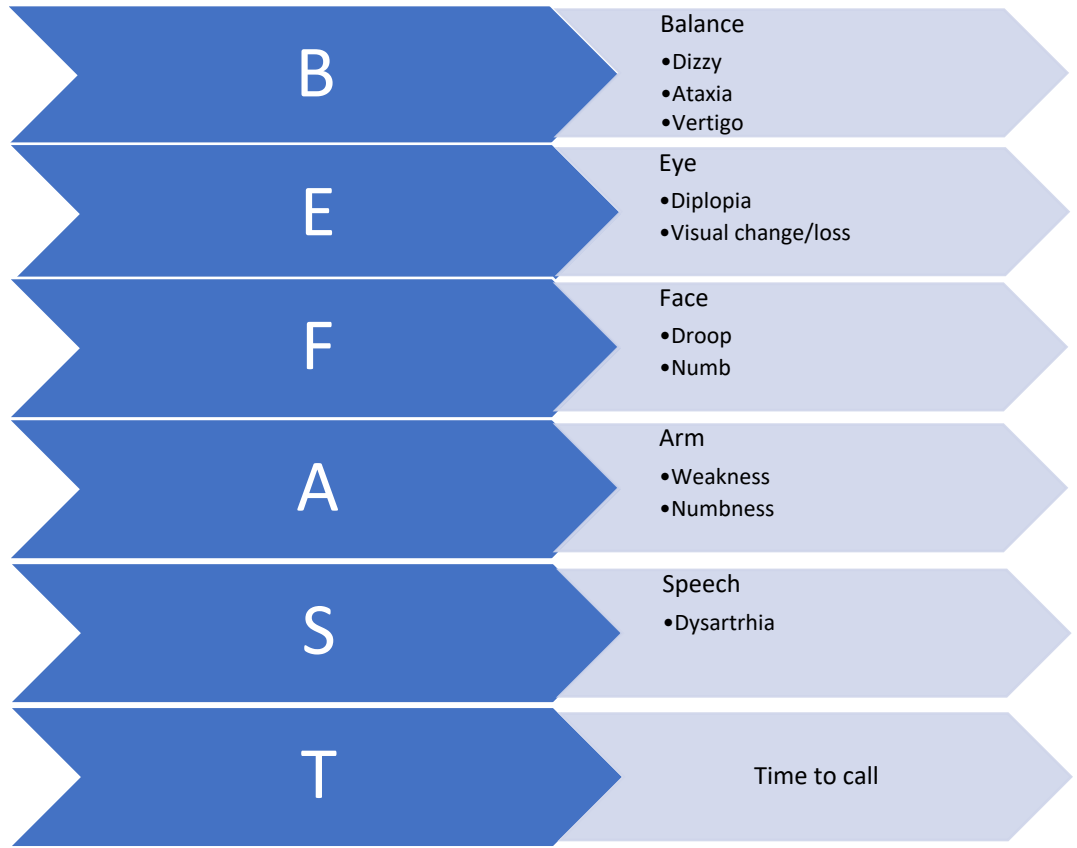
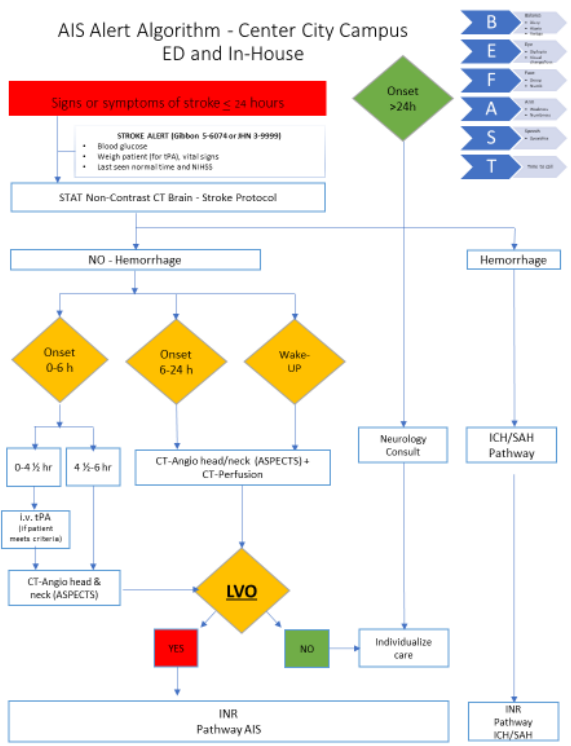
#215-554-4172 : Contact Stroke Alert Phone for STAT Results as soon as possible, Reason for Exam: Cerebral ischemia

ECG 12 lead

P Once, First occurrence today at 0909, STAT

Reason for exam: Arrhythmia - 149.9

Stroke Alert Protocol



Concern for Large Vessel Occlusion (LVO) RACE = Simplified NIHSS

Rapid Arterial Occlusion Evaluation (RACE) Scale

An EMS Assessment Tool for Acute Ischemic Stroke

(Sensitivity 85%, Specificity 68%)

| Test Item | Score = 0 | Score = 1 | Score = 2 | Patient Score |
|-----------------------------------|---------------------------------------|---------------------------------------|---|---------------|
| Facial Palsy | Absent | Mild | Moderate/Severe | |
| Arm Motor | Normal/Mild | Moderate | Severe | |
| Leg Motor | Normal/Mild | Moderate | Severe | |
| Head/Gaze Deviation | Absent | Present | N/A | |
| Aphasia* (if righthemiparesis) | Performs Both Tasks | Performs 1 Task | Performs Neither Tasks | |
| Agnosia* (if lefthemiparesis) | Patient Recognizes Arm and Impairment | Unable to Recognize Arm or Impairment | Unable to Recognize BOTH Arm and Impairment | |
| | | | TOTAL SCORE = (0-9) | |

*Aphasia: Ask the patient to: 1. "Close your Eyes" AND 2. "Make a Fist"

*Agnosia: Ask the patient and evaluate recognition of deficit:

1. While showing paretic arm: "Whose arm is this?"
2. Ask patient: "Can you lift both arms and clap?"

If RACE Score = 5 or greater, patient may have an ischemic stroke with a large vessel occlusion

Reference:

Natalia Pérez de la Ossa, et al. (2014). Design and Validation of a Prehospital Stroke Scale to Predict Large Arterial Occlusion: The Rapid Arterial Occlusion Evaluation Scale. *Stroke*, 45, 87-91. Retrieved from <http://stroke.ahajournals.org/content/45/1/87.full>

Patients Meeting Criteria for Thrombectomy

*ASU Admission Criteria

- NIHSS ≤ 5 within 24 hours of symptom onset with or without IV tPA
- NIHSS ≥ 5 after 24 hours of symptom onset without concern for neurologic decline
- Non-crescendo TIAs where workup not complete
- Intracranial hemorrhage with an ICH score of 1 or less.

** Clinical Considerations for a Higher Level of Care

Patients with stroke syndrome in whom loss of protective airway is of concern.

Patients requiring blood pressure augmentation for a confirmed pressure dependent neurologic exam

Patients requiring frequent (>1 time/hour) titration of continuous antihypertensive medications.

Patients post interventional neuroradiology procedure

Patients with a suspected basilar thrombosis

Patients with any secondary acute onset of organ dysfunction

Patients with post- Activase complications

Hemorrhage

DIC

Angioedema, anaphylaxis

INR Team: obtain consent, secure 2 IV sites, arterial line, and anesthesia

Check vital signs
MAP 70-100
Normoxia (Sat $>92\%$)
Normothermia
Cardiac monitor, EKG
Baseline neuro exam - NIHSS
Baseline labs (CBC, PT/PTT, INR, SMA-7, Mg, Phos)
Foley catheter

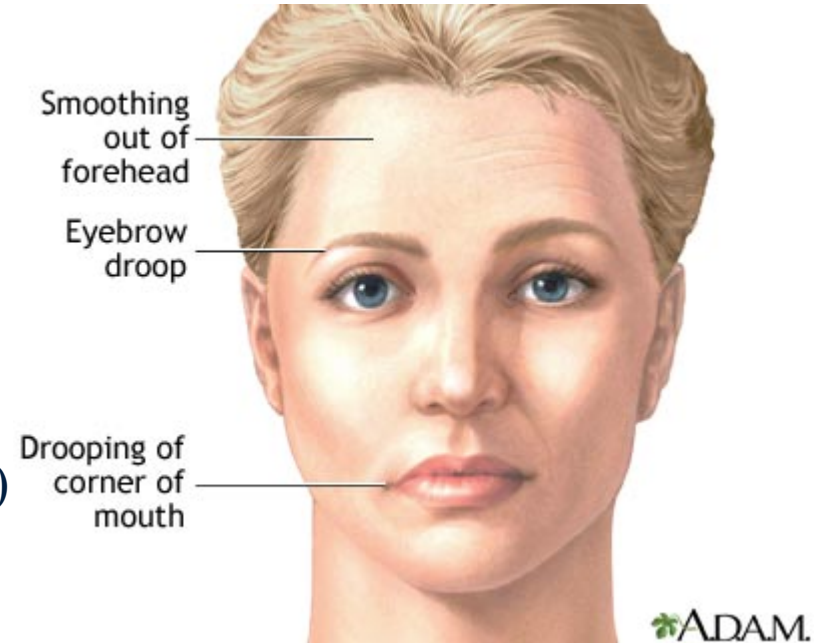
Evaluate for clinical trials:
215-964-4203

Admit to NICU
(Neurosurgery)

Start specific AIS post-mechanical thrombectomy protocol/pathway

Differential Diagnosis for muscular weakness, paresthesia, dizziness

- Seizure (Todd's paralysis)
- Bell's Palsy
- Complex migraine
- Spinal pathology
- Hypoglycemia
- Vestibulopathy
- Multiple Sclerosis
- Space occupying lesion (tumor, bleed, etc.)
- TIA/CVA



CDU Pathway: Joint EM-Neurology TIA Pathway

Inclusion Criteria

- Probability of discharge within 24 hours > 80%
- Neurology consultation notified in ED with stroke fellow and/or Silver Service attending evaluation and recommendations for provider
- ABCD² score documented by ED-Neurology less than or equal to 3 without cortical signs

Exclusion Criteria

- Meets criteria for inpatient admission
- Cortical signs present at any time
- Concern for large vessel occlusion
- ABCD² score greater than or equal to 4
- Hypertensive crisis requiring IV antihypertensives
- Concern for worsening neurological exam or depressed level of consciousness
- Probability of discharge home within 24 hours less than 80%
- Severe disability likely to require SNF or rehabilitation

CDU prefers patients at low risk for stroke...

TABLE 2
ABCD² scoring for transient ischemic attack⁶

| | Risk factor | Category | Score |
|---|-------------------|----------------------------------|-------|
| A | Age of patient | ≥60 years | 1 |
| | | <60 years | 0 |
| B | Blood pressure | ≥140/90 mm Hg | 1 |
| | | <140/90 mm Hg | 0 |
| C | Clinical features | Unilateral weakness | 2 |
| | | Speech disturbance (no weakness) | 1 |
| | | Other | 1 |
| D | Duration of TIA | Symptoms ≥60 minutes | 2 |
| | | Symptoms 10-59 minutes | 1 |
| | | Symptoms <10 minutes | 0 |
| D | Diabetes | Yes | 1 |
| | | No | 0 |


TIA, transient ischemic attack.

ABCD² score key

| ABCD ² score | 2-day stroke risk | 7-day stroke risk | 90-day stroke risk |
|-------------------------|-------------------|-------------------|--------------------|
| 0-3 (low risk) | 1% | 1.2% | 3.1% |
| 4-5 (moderate risk) | 4.1% | 5.9% | 9.8% |
| 6-7 (high risk) | 8.1% | 12% | 18% |

- Consider CDU admission if patient has been seen by Neurology Silver Service (dedicated stroke consult service) Fellow/Attending in ED with a specific plan for care outlined

| OK | NOT OK |
|--|--|
| Unchanged deficits from prior CVA awaiting MRI | New deficits not consistent with prior CVA |
| Numbness inconsistent with neuro distribution | Focal numbness concerning for cortical process |
| Known baseline dementia | Altered mental status from baseline |

|  2 Minute Medicine® ABCD2 Score 2minutemedicine.com | |
|--|--------|
| Risk Factor | Points |
| Age ≥60 years | 1 |
| Blood pressure elevation (systolic >140 mmHg and/or diastolic ≥90 mmHg) | 1 |
| <i>Clinical features</i> | |
| Unilateral weakness | 2 |
| Speech disturbance without weakness | 1 |
| <i>Duration of symptoms</i> | |
| ≥60 minutes | 2 |
| 10-59 minutes | 1 |
| Diabetes mellitus | 1 |

| ABCD2 Score | Patients | 2-day risk (%) | 7-day risk (%) | 90-day risk (%) |
|----------------|----------|----------------|----------------|-----------------|
| Low (0-3) | 1,628 | 1.0 | 1.2 | 3.1 |
| Moderate (4-5) | 2,169 | 4.1 | 5.9 | 9.8 |
| High (6-7) | 1,012 | 8.1 | 11.7 | 17.8 |

Table 1. The ABCD2 Score. | 2minutemedicine.com

Cortical Signs

Higher Mental Functions:

| | Cortical | Subcortical |
|-------------------------------|----------|-------------|
| Aphasia | x | |
| Alexia | x | |
| Agraphia | x | |
| Acalculia | x | |
| Neglect | x | |
| Visual spatial disorientation | x | |
| Memory impairment | x | |
| Behavioral change | x | |

Visual disturbance:

| | | |
|-----------------------|---|--|
| Homonymous hemianopia | x | |
| Gaze preference | x | |

Motor involvement:

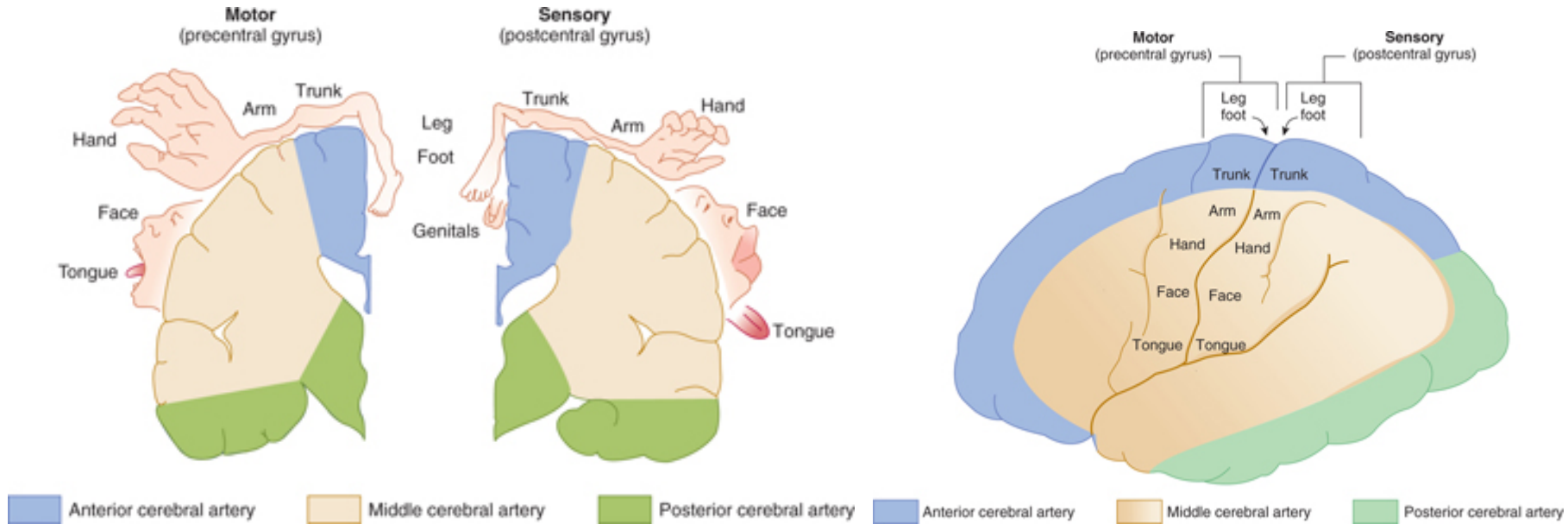
| | | |
|----------------------------------|---|---|
| Focal motor weakness | x | |
| Face/Arm > Leg or Leg > Face/Arm | x | |
| Face = Arm = Leg | | x |

Sensory involvement:

| | | |
|------------------------------|---|---|
| Agraphesthesia/Astereognosia | x | |
| Focal sensory loss | x | |
| Hemi-sensory loss | | x |

| | | |
|---|--|---|
| Brainstem findings (see above text for examples) | | x |
|---|--|---|

| | | |
|--|--|---|
| Cerebellar signs: (see above text for examples) | | x |
|--|--|---|



Simon RP, Aminoff MJ, Greenberg DA: *Clinical Neurology*, 4th ed. Appleton & Lange, 1999

Typical CDU Plan

Typical Observation Management

- Review ED diagnostic tests, lab work, and imaging for final results
- Monitor vital signs per floor protocol
- Neuro checks every 4 hours
- Telemetry
- Imaging (CT/MRI/MRA/ECHO) as per neurology recommendations
- Medications as per neurology recommendations
- Case management review within 12 hours
- Home care coordination as needed

Hospital Admission

- Abnormal imaging requiring hospitalization
- Unstable vital signs, suspected SIRS/Sepsis
- Deterioration in neurologic exam
- ABCD2 score greater than 3 with persistent deficits
- LOS exceeding 48 hours (as per case management recommendations)



TIA Treatment

- Definitive treatment is based on etiology
- Atherothrombotic: statin, aspirin, antiplatelet, BP control
- Embolic: anticoagulation, rate control (if due to atrial fibrillation)
- Carotid stenosis: carotid endarterectomy
 - Generally necessary when 70% of lumen is occluded

Why Observation?

- Evidence based
- “Impact of an Emergency Department Observation Unit Transient Ischemic Attack Protocol on Length of Stay and Cost” by Fadi Nahab, et al
 - Looked at 142 presumed TIA patients, before and after the department implemented an observation pathway for TIA
 - “Compared with the pre-ADP patients, the post-ADP patients (ADP and non-ADP) had a 20.8-hour shorter median LOS (95% confidence interval, 16.3-25.1 hours; $P < .01$) than pre-ADP patients and lower median associated costs (cost difference, \$1643; 95% confidence interval, \$1047-\$2238). The stroke rate at 90 days was low in both groups (pre-ADP, 0%; post-ADP, 1.2%).”

References

- Nahab F, Leach G, Kingston C, et al. Impact of an Emergency Department Observation Unit Transient Ischemic Attack Protocol on Length of Stay and Cost. *Journal of Stroke and Cerebrovascular Diseases*. 2012;21(8):673-678. doi:10.1016/j.jstrokecerebrovasdis.2011.02.017
- Johnston SC, Gress DR, Browner WS, Sidney S. Short-term prognosis after emergency department diagnosis of TIA. *JAMA*. 2000;284(22):2901-2906. doi:10.1001/jama.284.22.2901
- Marx, J. A., Hockberger, R. S., Walls, R. M., Biros, M. H., Danzl, D. F., Gausche-Hill, M., Jagoda, A., Ling, L., Newton, E., Zink, B. J., & Rosen, P. (2014). *Rosen's Emergency Medicine - Concepts and Clinical Practice: Vol. Eighth edition*. Saunders. Page 1384
- Tintinalli's Emergency Medicine Manual, 8th ed., Section 15, McGraw Hill Education, 2018.

References

- Furie, Karen. “Definition, Etiology, and Clinical Manifestations of Transient Ischemic Attack.” UpToDate, 24 Mar. 2020, www.uptodate.com/contents/definition-etiology-and-clinical-manifestations-of-transient-ischemic-attack?sectionName=DEFINITION%2BOF%2BTIA&search=tia&topicRef=1137&anchor=H2074998073&source=see_link#H53896871.
- Panuganti, Kiran K. “Transient Ischemic Attack.” *StatPearls [Internet].*, U.S. National Library of Medicine, 6 July 2020, www.ncbi.nlm.nih.gov/books/NBK459143/.
- Long, Brit. “Updates on TIA.” *EmDOCs.net - Emergency Medicine Education*, 5 July 2017, www.emdocs.net/8538-2/.
- “Clinical Differentiation: Cortical vs. Subcortical Strokes.” *Neurology Clerkship*, Case Western Reserve University School of Medicine, 2004, casemed.case.edu/clerkships/neurology/NeurLrngObjectives/NeurLrngObj_Stroke01new.htm.
- Simon RP, Aminoff MJ, Greenberg DA: *Clinical Neurology*, 4th ed. Appleton & Lange, 1999
- “Bell's Palsy.” *Mount Sinai Health System*, 2020, www.mountsinai.org/health-library/diseases-conditions/bell-palsy.



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