How Smart is SMARTS?

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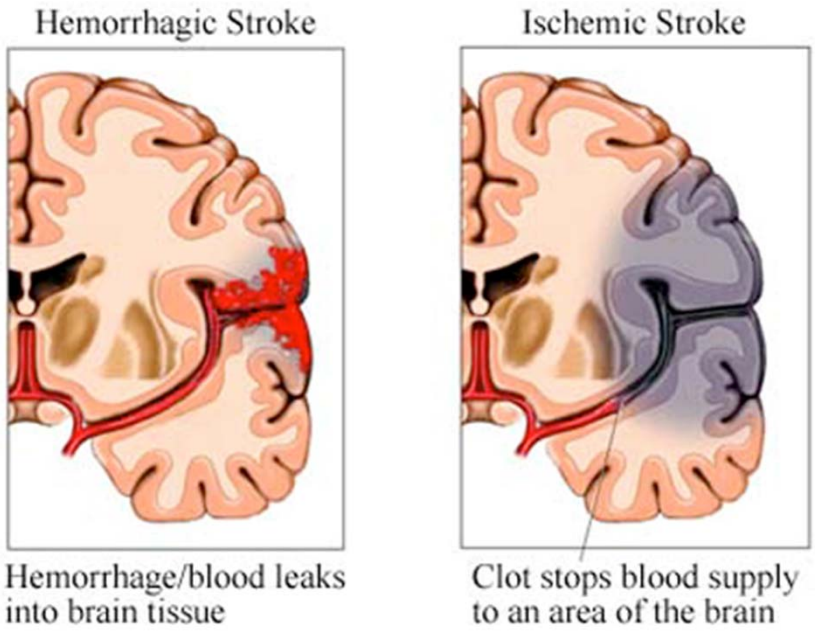
Stroke – Definition

- **SUDDEN** vascular event

- Ischemic stroke: flow interrupted by clot (thrombotic or embolic)

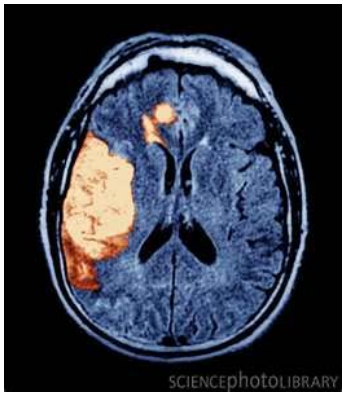
- Hemorrhagic stroke: ruptured blood vessel



Stroke – Definition

- **SUDDEN** loss of function
  - Stroke is the result of a vascular problem

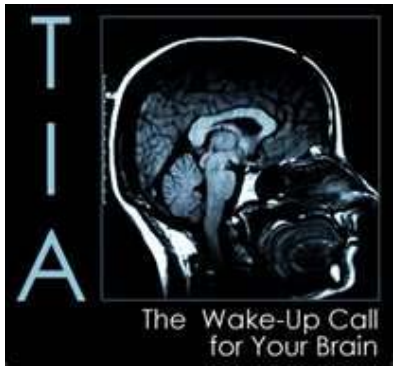
- Potential neurological deficit:
  - Visual disturbance
  - Difficulty speaking
  - Weakness or numbness of the face, arms, or legs
  - Difficulty walking or maintaining balance
  - *Rarely* loss of consciousness



Stroke – Time-Dependent Disease

- Minutes matter
  - *Stroke patient outcomes in US Hospitals Before the Start of the Joint Commission Primary Stroke Certification Program, Lichtman JH, et al., Stroke. 2009;40:3574-3579.*

- Treatment options:
  - IV t-PA at Primary Stroke Centers (PSC)
  - Intra-arterial t-PA, MERCI removal device, etc. for Stroke Centers with Interventional Capability (SCIC)



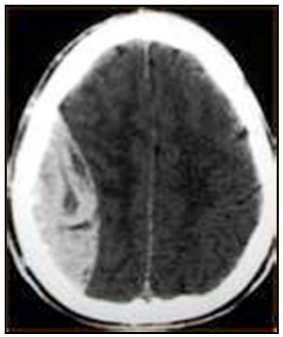
EMS Triage of Stroke

Is this patient having a stroke (or mimic)?
History, exam, monitor, sugar, temperature

Current system: Exam only.
Proposed system: All elements.

Stroke Mimics

- Todd's paralysis (post-seizure paralysis)
- Sepsis
- Hypo/hyperglycemia
- Syncope
- Alcohol/drug abuse
- Intracranial bleeding (epidural/subdural hematomas)
- Migraine
- Bell's Palsy



Stroke Identification
-Current system-

- History
  - Time last seen at baseline

- Physical Exam
  - Vital signs (heart rate, blood pressure)
  - Neurological exam (eye deviation, facial droop, motor deficit, speech deficit)

- On-scene assessment
  - Blood sugar

Stroke Identification
-Proposed system-

- Additional History
  - S – Signs (FAST exam)
  - A – Allergies (Iodine contrast allergy etc)
  - M – Medication (aspirin, clopidogrel, warfarin)
  - P – Past medical history (hypertension, diabetes, atrial fibrillation, previous stroke)
  - L – Last drink (alcohol)
  - E – Events to last time seen at baseline

- Additional Physical Exam
  - Leg weakness

- Additional on scene assessment
  - Temperature

STROKE

Minimize EMS scene time with prompt transport

Pre-hospital Stroke Scale:

1 Facial Droop: Ask the person to smile.
- Does the person understand and move both sides of their face evenly and with equal ease?

2 Arm Drift: Ask the person to close their eyes and raise both arms.
- Does the person understand and move both arms to the same level with ease?

3 Abnormal Speech: Ask the person to repeat a simple sentence.
- Does the person understand and is their speech understandable?

Difficulty with any of these tasks may indicate stroke.

Missouri Department of Health and Senior Services
Missouri Heart Disease and Stroke Prevention Program (MHDSP)
www.dhss.mo.gov/Stroke/

MHDSP Statewide Stroke Committee

10 Steps for Stroke Patients

1. Evaluate and monitor ABC's
2. Perform blood pressure monitoring (DO NOT treat hypertension)
3. Perform glucose fingerstick
4. Perform EKG
5. Administer O_2 (per local EMS protocol)
6. Perform prehospital stroke scale
7. Obtain medical history; determine time patient last seen normal
8. If local protocol allows, take a family member to the hospital
9. Minimize screen time; procedures can be performed during transport
10. Transport patient to the nearest appropriate hospital per local transport protocols; notify receiving hospital en route.

Benefits and Risk of t-PA

- Minimally treated stroke – 20% improvement.
- IV t-PA candidates – 30% improvement.
  - t-PA given 2-5% in Emergency Departments
- t-PA risk – 6% intracranial hemorrhage

Contraindications for IV Thrombolysis

- Symptoms > 4.5 hours
- Seizure with Todd's paralysis
- Previous intracranial hemorrhage
- Intracranial surgery or stroke in past 3 months
- Anticoagulation (on Warfarin, Dabigatran)
- Serum glucose < 50 or > 400
- HTN > 185/110

Interventional Neuroradiology

- 3 indications:
  - IV t-PA contraindicated
  - Symptoms > 4.5 hours up to 8 hours
  - No improvement with IV t-PA
- Case-by-case basis, depends on:
  - Age of patient
  - Deficit
  - Duration of symptoms
  - Large vessel clot seen on imaging

- Contraindications similar to IV t-PA

Where Have We Been?

Cincinnati Prehospital Stroke Scale

- 3 items based on exam only:
  - Facial droop
  - Arm drift
  - Speech impairment

- Excellent reproducibility for prehospital providers for each item
- Excellent agreement between prehospital providers and physician

Cincinnati Prehospital Stroke Scale

- Published in 1999
- San Mateo County uses this scale
- Most commonly used stroke scale

- Frendl DM et al: Stroke 2009 CONCLUSION
  - Training CPSS doesn't impact paramedics' stroke identification.

Cincinnati Prehospital Stroke Scale

Original CPSS results:

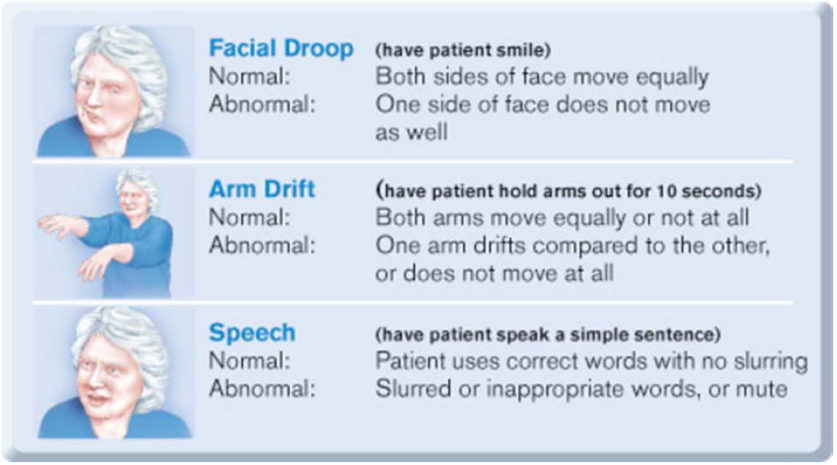
	Physicians		Prehospital Providers	
# of deficits	Sensitivity	Specificity	Sensitivity	Specificity
1	66%	87%	59%	88%
2	26%	95%	27%	96%
3	11%	99%	13%	98%

Frendl DM et al: *Stroke*, 2009

Sensitivity: 71%, Specificity: 52% out of 154 patients

Cincinnati Prehospital Stroke Scale

- Advantages:
  - Easily learned
  - Does not require ALS skills
  - Can be performed rapidly
  - Results very reproducible



- Disadvantages:
  - Sensitivity and specificity less than desirable
  - Potentially misses posterior circulation strokes
  - Does not eliminate stroke mimics

Where Are We Now?

Current SM County Policy

Destination	Onset of symptoms from baseline
Primary Stroke Center	<3.5 hours
Comprehensive Stroke Center	3.5 – 7 hours
Nearest medical facility	> 7 hours

- Paramedic identifies patient as a stroke alert if symptoms < 7 hours
- Other necessary information:
  - Time last known well
  - Deficit(s) appreciated
  - Blood sugar
  - Treatment provided
- PCR left for receiving hospital

San Mateo County Data

Problems with Current System

- 40-50% of stroke alerts are mimics
- Most diverted stroke patients are not t-PA candidates
  - Outside treatment window
  - Meet exclusion criteria for t-PA (e.g. seizure)
    - Policy doesn't screen for exclusions

What we could use

Prehospital Stroke Recognition Instruments

Table 1 | Prehospital stroke recognition instruments

Name	Advantages	Disadvantages
Los Angeles Paramedic Stroke Scale (LAPSS)[50]	High sensitivity (91%) and high specificity (97%) for prehospital stroke identification; has increased the accuracy of stroke diagnosis made by paramedics after implementation	Excludes some conditions that mimic stroke; not useable for public education; more time-consuming than other scales
Cincinnati Prehospital Stroke Scale (CPSS)[51]*	High sensitivity (90%) for prehospital stroke identification	Moderate specificity (66%) for prehospital stroke identification
The 'suddens' message[49]	Identifies 99.9% of patients with stroke or TIA	No study has examined the retention and public comprehension of the message from the study
Face Arm Speech Test (FAST)[53]	Identifies 88.9% of patients with stroke or TIA; easy to perform by paramedics and non-medics; useful as a public message	Poor sensitivity in detecting posterior circulation syndrome stroke and hemorraghic stroke

*The CPSS was the forerunner of FAST. Abbreviation: TIA, transient ischemic attack.

Bouckaert, M. *et al.* (2009) Reducing prehospital delay in acute stroke*Nat. Rev. Neurol.* doi:10.1038/nrneurol.2009.116

Issues with Over-Triage

- Patients generally better served at home facility
  - Increased time spent in ED
  - Increased costs evaluating patient
  - Increased work transferring patient
  - Increased risk of ED crowding
  - Decreased patient satisfaction

Where Are We Going?

San Mateo Assessment Risk Tool for Stroke

SMARTS

SMARTS Pilot Project

- THE San Mateo County EMS Agency and the Stroke QI Committee approved implementation of a research project studying the SMARTS Assessment Tool
- This is a formal research project approved through an Internal Review Board (IRB) at Stanford Hospital
- The SMARTS Study will compare the effectiveness of stroke triage with the Cincinnati Stroke Scale and the SMARTS Tool

SMARTS Pilot Project

- The SMARTS Study design requires 12 months of data collection.
  - Phase one data (already seen)
    - 5 months based on Cincinnati Stroke Scale.
    - Was completed by AMR, SMC EMS and the SMC Designated Stroke Centers.
- The 2nd phase involves use of SMARTS by paramedics in San Mateo County.
  - Destination decisions are made using Cincinnati Stroke Scale
- Enrolled patients need BOTH a Cincinnati Stroke Scale and SMARTS tool documented.

SMARTS– Two Goals

- Identify potential strokes better
  - Add criteria to identify stroke mimics

- Minimize diversion of stroke patients
  - Add criteria for contraindications for therapy

History/Screening Criteria (SMARTS)

Onset > 7 hours	o Yes	o No
History of seizures and on anticonvulsants	o Yes	o No
Chronically bed-ridden or wheelchair bound (baseline)	o Yes	o No
Blood sugar < 60 or > 400	o Yes	o No
Comatose or responsive only to painful stimuli	o Yes	o No
Temperature ≥ 100.4	o Yes	o No

Physical Exam (SMARTS)

Must have at least one of the following:

Unilateral facial droop	o No – both sides move equally	o Yes – one side of face is weaker
Arm drift	o No – no arm drift	o Yes – unable to move one arm or has unilateral drift
Leg drift	o No – no leg drift	o Yes – unable to move one leg or has unilateral drift
Speech disturbance – patient repeats ("The sky is blue in California")	o No – no change from baseline speech per witnesses/ patient	o Yes – Slurred or inappropriate words or unable to speak

SMARTS Data

Conclusions

- San Mateo County EMS knows:
  - Cincinnati Prehospital Stroke Scale is Okay
    - We can do better than flipping a coin
  - Other Prehospital Scales Exist
    - SMARTS is an attempt to validate another one
    - Currently at 85% accuracy
    - Stay tuned!!

Questions?