Prehospital Stroke Scales: A Balanced Approach

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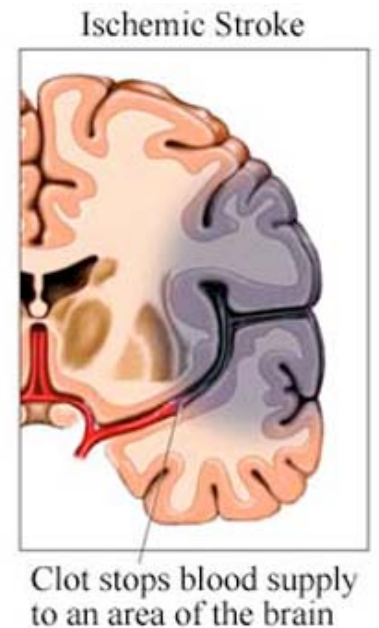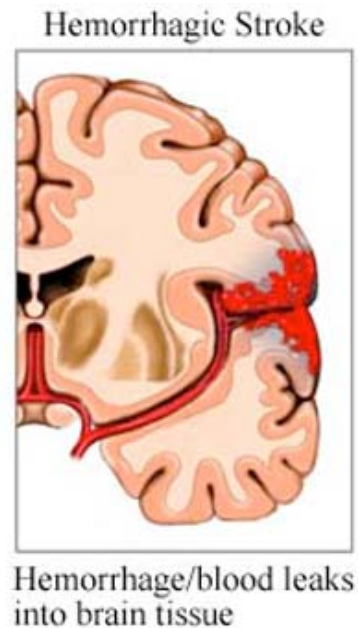KAISER PERMANENTE.

Objectives

- Identify: key history and physical exam points when evaluating potential stroke patients
- Review: prehospital stroke scales/screens to evaluate stroke patients
- Understand: the advantages and limitations of prehospital stroke scales/screens
- Discuss: prehospital management of stroke patients

Stroke – Definition

- The <u>sudden</u> death of brain cells in a localized area due to inadequate blood flow
- Ischemic stroke: blood flow is interrupted from a clot (thrombotic or embolic)
- Hemorrhagic stroke: blood flow is interrupted from a leak in a blood vessel

Hemorrhagic Stroke

Ischemic Stroke

Hemorrhage/blood leaks into brain tissue

Clot stops blood supply to an area of the brain

Stroke Happens

3rd leading cause of death in the USA

The <u>leading cause of disability</u> in the USA

One American suffers a stroke *every minute*

One American dies from a stroke every 3.5 minutes

Typical EMS responder sees 4–10 stroke patients/year

Stroke and EMS

- EMS role critical in management of strokes
  - Identification of potential stroke patients
  - Rapid delivery to stroke centers
  - Improved door to MD and door to intervention times

- American Stroke Association, Joint Commission, and NAEMSP all emphasize EMS

Acute Stroke Interventions

- Blood pressure, glucose, and temperature control
- IV thrombolysis (t-PA)
- Intra-arterial therapy
- Mechanical thrombectomy (MERCI retrieval)
- Angioplasty and stenting
- Hypothermia
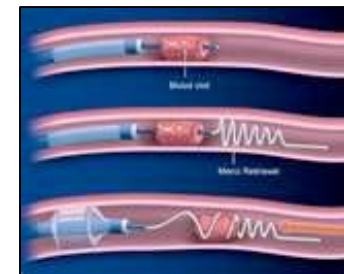
TIME-DEPENDENT

EMS Triage of Stroke

Triage

- The process of sorting victims to determine medical priority in order to increase the number of survivors
- The determination of priorities for action in an emergency

Bottom line: Getting the patient to the appropriate facility for expedited treatment

EMS Triage of Stroke

- Is this patient having a stroke (or mimic)?
  - *History, exam, monitor, sugar*
- Is it possible to determine stroke severity?
  - *Neurological exam*
- What treatment can I provide on scene that might make a difference?
  - *Positioning, prenotification, rapid transport*
- What therapies are available if I take this patient to a stroke center?
  - *Benefits and limitations of these therapies*

Stroke Mimics

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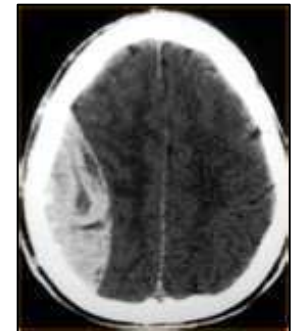
Stroke Identification

- History
  - <u>Baseline</u> status
  - Time last seen at baseline
  - Past medical history (hypertension, diabetes, atrial fibrillation, previous stroke)
  - Medications (particularly aspirin, clopidogrel, and warfarin)
  - Social history (e.g. alcohol)
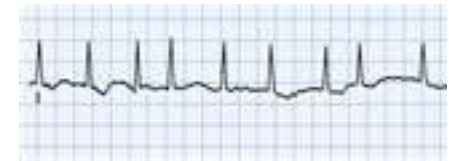
Stroke Identification

- Physical Exam
  - Vital signs (heart rate, blood pressure)
  - Level of consciousness
  - Cardiac exam (irregular heart beat)
  - Neurological exam (eye deviation, facial droop, motor deficit, speech deficit)

- On-scene assessment
  - Monitor (atrial fibrillation)
  - Blood sugar

Studied Stroke Scales/Screens

- Cincinnati Prehospital Stroke Scale (CPSS)
- Los Angeles Prehospital Stroke Screen (LAPSS)
- Melbourne Ambulance Stroke Screen (MASS)
- Ontario Prehospital Stroke Screening Tool (OPSS)
- NIHSS and sNIHSS (for EMS)

Cincinnati Prehospital Stroke Scale

- Kothari RU et al: *Ann Emerg Med,* 1999
- Goal: verify reproducibility and validate its ability to identify stroke patients
- Most commonly used stroke scale, including all SF Bay Area counties
- Oldest and most studied scale
- 860 scales completed by 4 EMTs/paramedics and 1 ED physician on 171 patients in the ED and neurology inpatient service
  ◦ 38/171 stroke, 11/171 TIA

Cincinnati Prehospital Stroke Scale

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

- Excellent reproducibility for prehospital providers for total score and for each item
- Excellent agreement between prehospital providers and physician (individual and total)

Cincinnati Prehospital Stroke Scale

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

- 13 patients had stroke <u>not</u> identified by the CPSS, 10 of whom had a posterior circulation stroke
- 21/24 patients with anterior circulation stroke had a +CPSS

Cincinnati Prehospital Stroke Scale

- Frendl DM et al: *Stroke*, 2009
- Goal: assess impact of routine training and use of CPSS on the accuracy of EMS identification of stroke patients and scene time
- Found that simple EMS training (1 hour) of the CPSS had no impact on the EMS identification of stroke or on scene time
- 70% of stroke patients had at least one finding
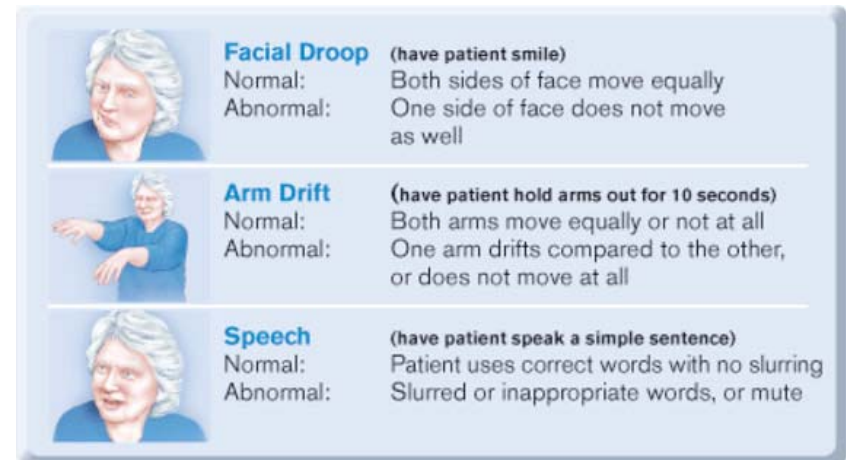- Sensitivity: 71%, Specificity: 52% out of 154 patients

Cincinnati Prehospital Stroke Scale

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

Facial Droop (have patient smile)
Normal: Both sides of face move equally
Abnormal: One side of face does not move as well

Arm Drift (have patient hold arms out for 10 seconds)
Normal: Both arms move equally or not at all
Abnormal: One arm drifts compared to the other, or does not move at all

Speech (have patient speak a simple sentence)
Normal: Patient uses correct words with no slurring
Abnormal: Slurred or inappropriate words, or mute

▶ Disadvantages:
  ◦ Sensitivity and specificity less than desirable
  ◦ Could potentially miss more posterior circulation strokes
  ◦ Does not try to eliminate stroke mimics

LA Prehospital Stroke Screen

- Kidwell CS et al: *Stroke,* 2000
- 3 ALS units near UCLA Medical Center
- 60 minute training session followed by brief certification tape of sample patients
- 206 completed forms/446 patients with neurological complaints (36 target strokes)
  - Age $\geq$ 18
  - Neurologically-relevant complaint
  - No coma
  - No trauma

LAPSS – Goal

- Designed to allow rapidly identification of the most frequent types of strokes
- Also designed to exclude the most common stroke mimics or patients that would not benefit from acute intervention
- Motor skills emphasized: 80-90% of all stroke patients have unilateral motor weakness

- Ratio of nonstroke, neurologically relevant patients to actual stroke patients: 11:1

LAPSS

▶ Screening criteria (History):
  ◦ Age > 45
  ◦ History of seizures or epilepsy <u>absent</u>
  ◦ Symptom duration < 24 hours
  ◦ At baseline, patient is not wheelchair-bound bedridden

  ALL CRITERIA HAVE TO BE <u>YES</u> TO PROCEED

▶ Test
  ◦ Fingerstick: between 60-400

LAPSS

▸ Exam: Look for OBVIOUS ASYMMETRY

	Normal	Right	Left
Facial Smile/Grimace		o Droop	o Droop
Grip		o Weak grip o No grip	o Weak grip o No grip
Arm Strength		o Drifts down o Falls rapidly	o Drifts down o Falls rapidly

▸ Patient must have only <u>unilateral</u> weakness
▸ If all criteria from screening, blood sugar, and exam are YES → Stroke Code called

LAPSS – Breakdown of Results

	True strokes excluded	Stroke mimics excluded
Age < 45	0	47
Absence of seizure	0	22
Symptoms> 24 hours	1 (ICH)	10
Baseline wheelchair-bound/bedridden	0	14
Blood glucose 60–400	0	4

LAPSS – Breakdown of Results

- Blood glucose 60-400: no true strokes excluded, 4 potential strokes excluded
- Facial weakness: 2 TIAs identified, 1 stroke
- Grip weakness: 3 strokes identified
- Arm strength: 1 stroke identified

- Bilateral weakness excluded 6 mimics but did eliminate 2 true strokes

Melbourne Ambulance Stroke Screen (MASS)

- Bray JE et al: *CerebrovascDis*, 2005
- CPSS + LAPSS = MASS
- Goal: eliminate stroke mimics and identify suitable patients for thrombolysis
- 18 paramedics: 100 assessments over 12 month period
  - 73% of these assessments were strokes/TIAs
  - 27% of these assessments were stroke mimics
- CPSS, LAPSS also evaluated at the same time

MASS Study – Results

	LAPSS	CPSS	MASS
Sensitivity:	78%	95%	90%
Specificity:	85%	56%	74%

- All patients misidentified by MASS (7 strokes, 7 mimics) were ineligible for thrombolytics
- MASS identified the all patients who required thrombolytics (13)
- No one motor or speech item proved particularly helpful

Ontario Prehospital Stroke Screening Tool (OPSS)

- Chenkin J et al: *PrehospEmerg Care* , 2009
- Goal: determine the positive predictive value (PPV) for the diagnosis of acute stroke
- 325 patients triaged under acute stroke protocol over 12 month period
- PPV was 89.5% for acute stroke
- 34 patients (11%) had nonstroke conditions
- Rate of t-PA administration for all stroke patients increased from 5.9% to 10.1%

OPSS

- New-onset (one of the following must be present):
  - Unilateral arm/leg weakness or drift
  - Slurred or inappropriate words or mute
  - Facial droop

AND

- Can be transported within 2 hours time of onset

OPSS – Contraindications

ANY of the following excludes stroke alert:

- CTAS Level 1 and/or uncorrected airway/breathing/circulation problem
- Resolved symptoms
- Blood sugar < 4 mmol/liter (75 mg/dl)
- Seizure at onset of symptoms or observed by paramedic
- GCS < 10
- Terminally ill/palliative care patient

Comparing Stroke Screens

- Bergs J et al: *Eur Journal Emerg Med*, 2010
- Compared the CPSS, FAST, LAPSS, and MASS in Belgium
- 31 surveys completed/70 neurological complaints (1131 nontraumatic EMS runs)

	Sensitivity	Specificity	PPV
CPSS	95%	33%	69%
LAPSS	74%	83%	88%
MASS	74%	67%	78%
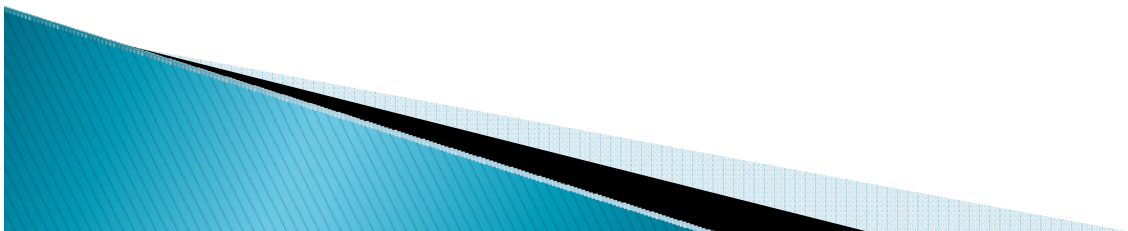
Comparing Stroke Screens

| Author	Scale	Sensitivity	Specificity	PPV
Kothari et al	CPSS	59%	88%	
Kidwell et al	LAPSS	91%	97%	86%
Bray et al	CPSS	95%	56%	85%
Bray et al	LAPSS	78%	85%	93%
Bray et al	MASS	90%	74%	90%
Chenkin et al	OPSS			90%

NIHSS &Prehospital Setting

- 15 questions, 42 point scale
- Advantages:
  - The "Gold Standard"
  - Very reproducible between examiners
  - Picks up subtle strokes
  - Prognostic value

- Disadvantages
  - Takes 2-3 hours to learn (for physicians)
  - Takes 5-10 minutes to conduct
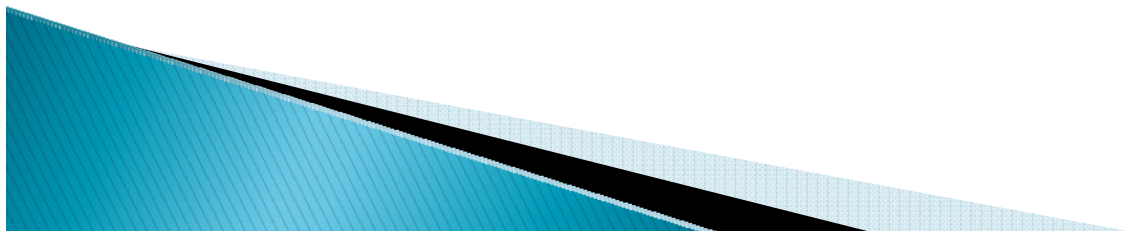
EMS: Predicting Stroke Severity

- Tirschwell DL et al: *Stroke,* 2002
- Goal: identify the key exam points from the NIHSS that could measure <u>stroke severity</u> and <u>predict outcomes</u>
- Shortened NIHSS (sNIHSS) derived from NIHSS
- *Not tested as a tool to identify stroke patients in the first place*
- Greatest prognostic factor was leg weakness
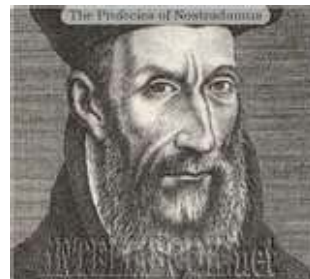
EMS: Predicting Stroke Severity

sNIHSS-8	sNIHSS-5
1a. Level of consciousness	
2. Gaze	X
3. Visual fields	X
4. Facial paresis	
6a. Motor leg – right	X
6b. Motor leg – left	X
9. Language	X
10. Dysarthria	

	sNIHSS-8	sNIHSS-5
Correlation with NIHSS-15:	0.93	0.88

EMS: Predicting Stroke Severity

- Nazliel et al: *Stroke*, 2008
- Los Angeles Motor Scale (LAMS) – 3 items
  - Facial droop (absent=0, present=1)
  - Arm drift (absent=0, drift down=1, rapid fall=2)
  - Grip strength (normal=0, weak=1, none=2)
- Applied to 119 patients with large artery anterior circulation strokes
- Takes 20–30 seconds (no extra time)
- Good interrater reliability
- Predicts final stroke functional outcomes

EMS: Predicting Stroke Severity

- Score of $\geq$ 4: sensitivity 81%, specificity 89%
- Derived from a previously validated screen
- Authors proposed LAMS $\geq$ 4 with symptoms > 3 hours be routed to Comprehensive Stroke Centers
- Limitation: scale done by physicians upon patient arrival to the hospital (not tested in the field)

Field Treatment of Stroke

- Millin MG et al: *PrehospEmerg Care*, 2007
- Head positioning: zero degrees
  - Intracranial pressure peaks 48 hours after infarct
  - 20% improvement in middle cerebral artery perfusion in flat position vs Fowlers position (30°)
  - Caution with aspiration risk
- Supplemental oxygen: normoxia best
  - Low-flow oxygen unless patient is hypoxic
  - No proven benefit
  - Hyperoxia may be harmful

Field Treatment of Stroke

- IV access: large bore, antecubitalfossa best
  - Optimal for IV contrast
  - Establish en-route to minimize scene time
- IV fluids: run saline TKO if hemodynamically stable
  - No proven benefit of IV fluids
  - Hypertonic saline or D5 worsened infarcts
- ECG monitoring: continuous recommended

Field Treatment of Stroke

- Blood glucose: must check!
  - Hypo/hyperglycemia can cause focal neuro deficits
  - Hypoglycemia (severe or prolonged) = brain injury
  - Hyperglycemia increases stroke morbidity/mortality (increases cerebral edema, promotes hemorrhagic transformation, and worsens postischemic injury)
- Aspirin: theoretically could be given
  - Benefit still present if given within 48 hours
  - 2 problems: hemorrhagic stroke, possible aspiration

Field Treatment of Stroke

- Blood pressure: better to let body autoregulate
  - Cerebral autoregulation often disrupted with ischemia → cerebral perfusion depends on systemic blood pressure
  - Lowering BP within first 24 hours often worsened outcomes
  - For ischemic stroke: SBP 140–180 mm Hg optimal
  - For hemorrhagic stroke: SBP < 130 mm Hg optimal
- Prenotification: Proven helpful
  - Mosley I et al: *Stroke*, 2007; improved hospital arrival time to first MD assessment (10 vs 23 minutes)

Contraindications for IV Thrombolysis in Stroke

- Symptoms > 3 hours (4.5 hours in some cases)
- Seizure with post-ictal residual neuro deficit
- Previous intracranial hemorrhage
- Intracranial surgery or stroke in past 3 months
- Anticoagulated (INR > 1.5)
- Spontaneous improvement of neuro deficit
- Serum glucose < 50 or > 400
- Relative warnings: age > 77 or massive stroke

t-PA given 5-15% in Emergency Departments

Suggested Stroke Screen Criteria to Divert to a Stroke Center

- Transport to stroke center < 3.5 hours
- No witnessed seizures or history of seizures
- Not wheelchair-bound/bedridden at baseline
- Not comatose or only responsive to painful stimuli
- Glucose 60–400
- <u>One of the following must be present</u>: facial droop, impaired speech, arm drift, leg drift

Conclusions

- Diagnosis often difficult
- Use all tools to evaluate patients
  - History (time of onset, medications, risk factors)
  - Neurological exam (level of consciousness, speech, eye deviation, facial droop, arm/leg weakness)
  - Monitor, blood sugar
- Treatment: positioning, oxygen, IV access
- Be familiar with contraindications for thrombolysis
  - American Stroke Association supports EMS screening

Contact Information

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