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Acute Stroke Update

2017

Stroke Therapy: What has changed?

- Large Vessel Occlusion
 - Low rates of re-canalization after tPA
 - Only **25 % of large vessel strokes re-canalization after tPA**
- Newer invasive techniques
 - **Solitaire** vs Merci
- **Better identification of patients** who may benefit from therapy

Positive Embolectomy Trials

	MR CLEAN	EXTEND IA	ESCAPE	SWIFT PRIME	RE-VASCAT
Country	Netherlands	Australia, NZ	Canada	U.S.	Spain
No. enrolled	500	70	316	196	206
Time to IA needed	6 hours	6 hours	12 hours	6 hours	8 hours
Imaging required for inclusion	CT	CT perfusion	CTA for core, collaterals	CT perfusion; later CTA	Favorable ASPECTS
IV tPA	89%	100%	76%	100%	73%
Stentriever	82%	100%	86%	100%	100%
mRS 0-2 outcome	33% vs 19%	71% vs 40%	53% vs 29%	60% vs 36%	44% vs 28%

NEJM 2015;372:11-20; NEJM Feb. 11, 2015 x 2; NEJM April 17, 2015



Acute Stroke:2015 Published Studies

Interventional Therapy

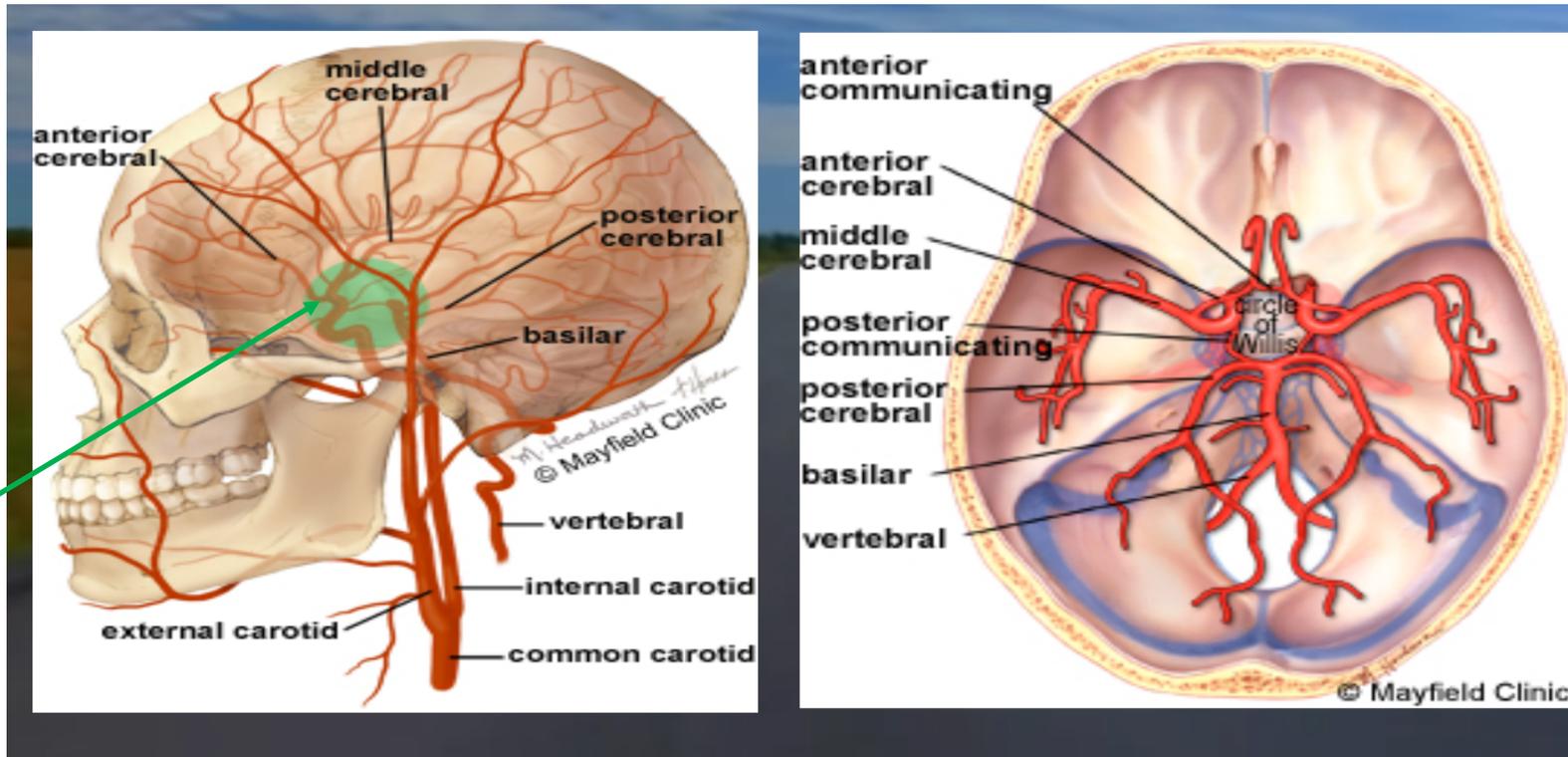
Name	Author	Improved Functional Outcome	Decreased Mortality
Mr. Clean	Berkhemer	YES	No
EXTEND	Campbell	YES	No
REVASC	Jovin	YES	No
ESCAPE	Goyal	YES	YES
SWIFT PRIME	SAVER	YES	No

AHA/ASA Guidelines 2015 Update

- Patients eligible for intravenous r-tPA should receive intravenous r-tPA even if endovascular treatments are being considered (*Class I; Level of Evidence A*).
- Patients should receive **endovascular therapy with a stent retriever** if they meet all the following criteria (*Class I; Level of Evidence A*). (New recommendation):
 - a. Prestroke mRS score 0 to 1,
 - b. Acute ischemic stroke receiving **intravenous r-tPA within 4.5 hours** of onset according to guidelines from professional medical societies,
 - c. Causative occlusion of the **ICA or proximal MCA (M1)**,
 - d. Age ≥ 18 years,
 - e. NIHSS score of ≥ 6 ,
 - f. ASPECTS of ≥ 6 , and
 - g. Treatment can be initiated (groin puncture) within **6 hours of symptom onset**

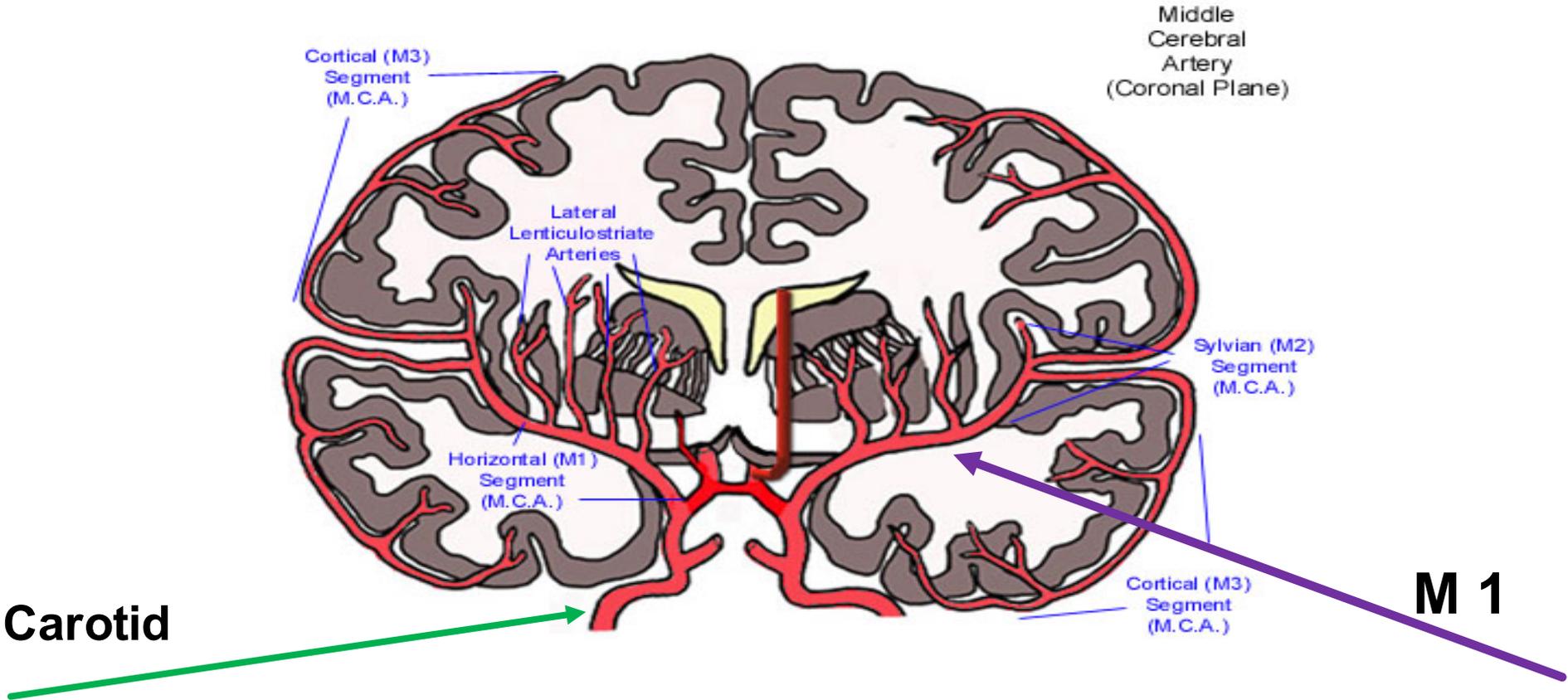
Review of Brain Circulation and Associated Functional Areas

Cerebral Circulation



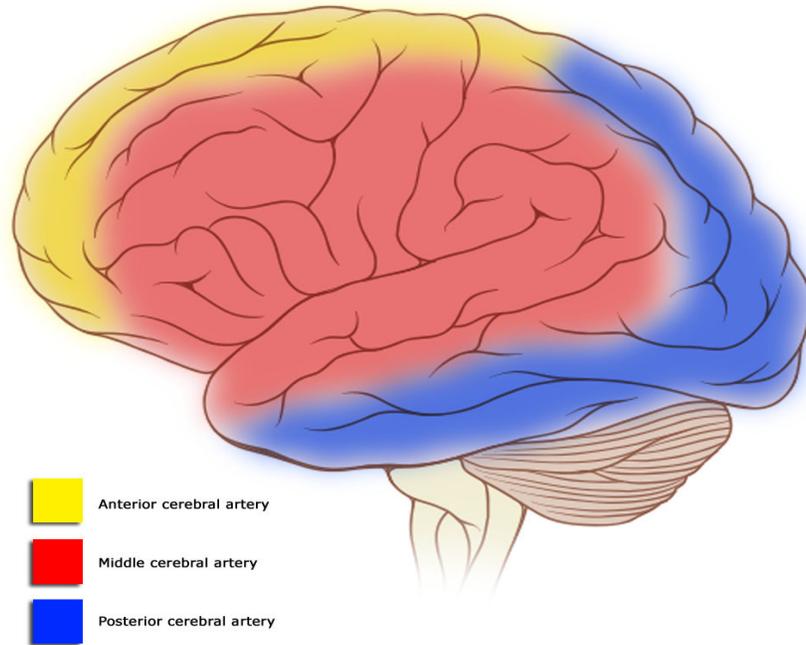
middle

Acute Stroke: Large Vessel Anatomy

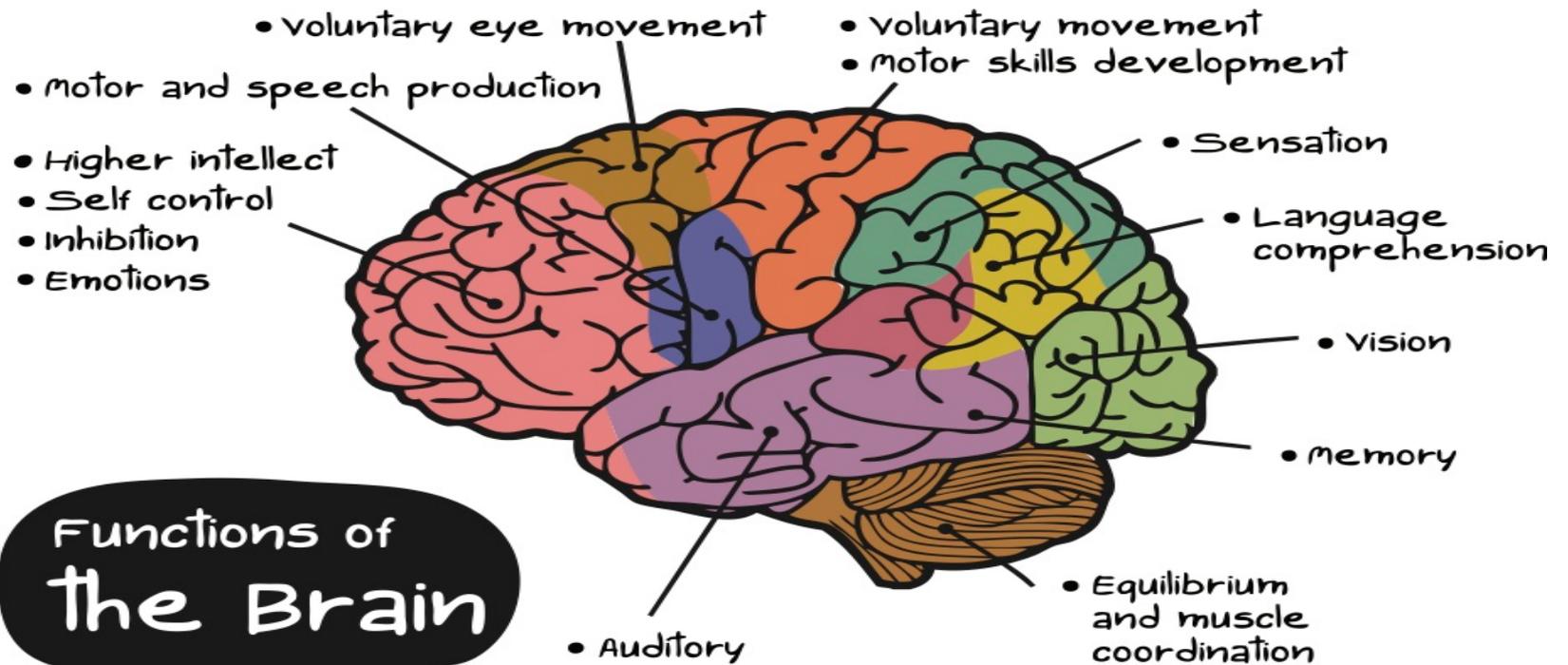


Brain: Blood Supply

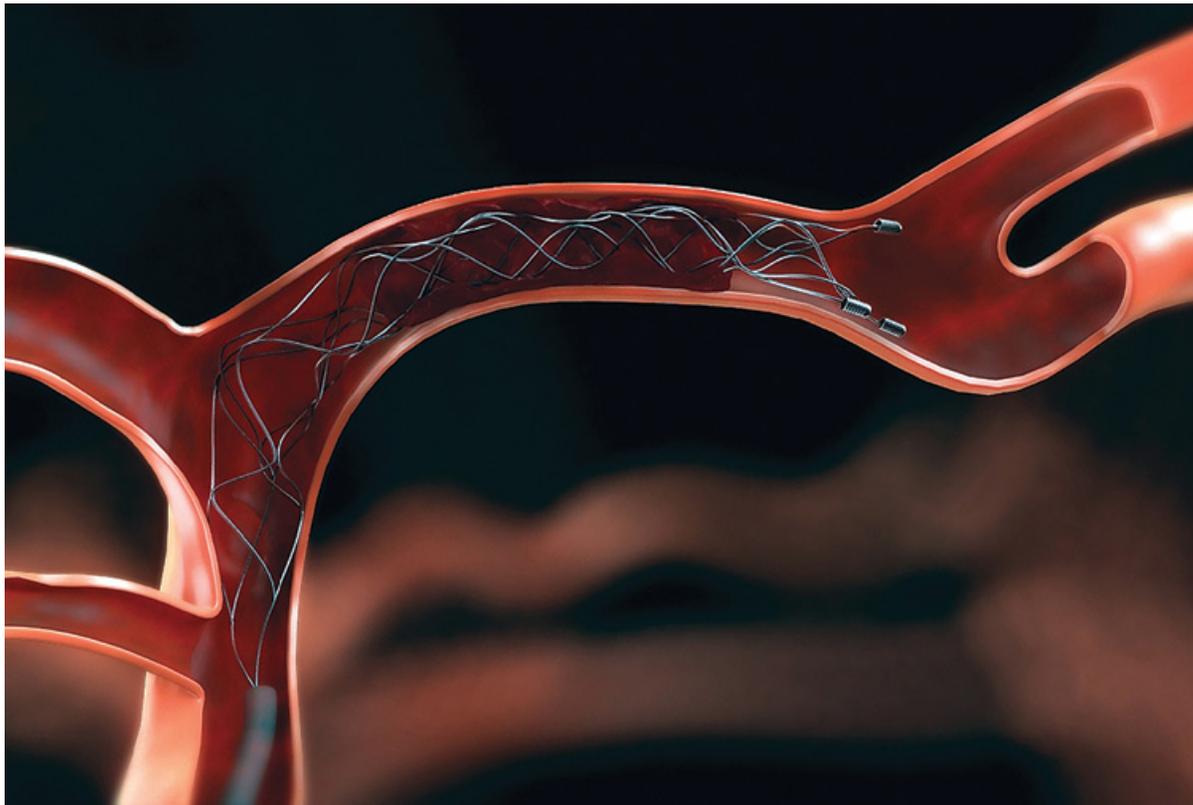
Cortical vascular territories



Functional Areas of the Brain



Solitaire Device



Solitaire Device with Clot

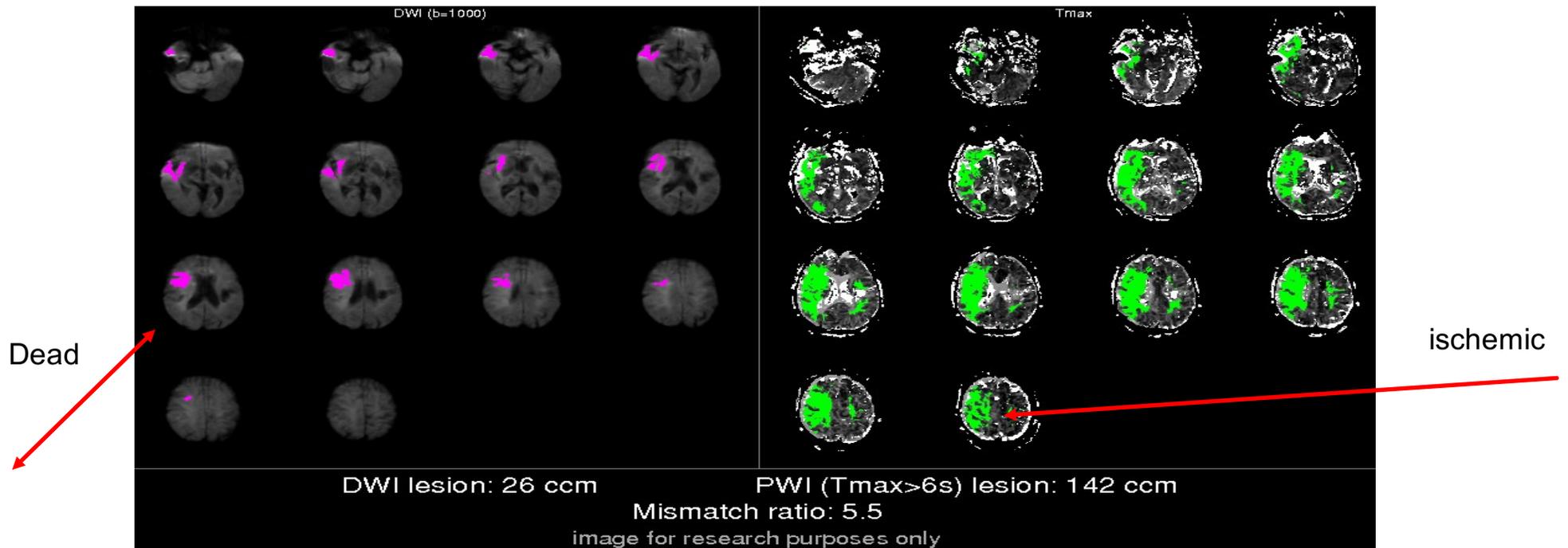


Newer brain Imaging
Ability to identify areas of ischemia

Stroke Imaging (MRI)

Dead tissue vs Ischemic Tissue

- Presented to outside ED with left hemiparesis, right gaze preference



How do these advances impact EMS?

EMS Options

- Does the patient have a stroke?
- If yes, does the patient have a large vessel stroke (LVO)?

EMS Options

- **Primary** Stroke Centers
 - transported to primary stroke centers, receive tPA and then transfer to interventional stroke centers
- **Interventional** Stroke Centers
 - preferentially be transported to interventional stroke centers.

EMS Stroke Triage Options

NIH Stroke Scale vs Stroke Screening

NIHSS	Cincinnati	LAPSS
1.1 1. Level of Consciousness		
1.2 2. Horizontal Eye Movement		
1.3 3. Visual field test		
1.4 4. Facial Palsy	YES	YES
1.5 5. Motor Arm	YES	YES
1.6 6. Motor Leg		
1.7 7. Limb Ataxia		
1.8 8. Sensory		
1.9 9. Language		
1.10 10. Speech	YES	
1.11 11. Extinction and Inattention (Neglect)		

Large Vessel Stroke: Clinical Screening

	C-STAT	3I-SS (LAG)	RACE	LAMS
1.1 1. Level of Consciousness	Yes	Yes		
1.2 2. Horizontal Eye Movement	Yes	Yes	Yes	
1.3 3. Visual field test				
1.4 4. Facial Palsy			Yes	Yes
1.5 5. Motor Arm	Yes	Yes	Yes	Yes (+ Grip strength)
1.6 6. Motor Leg		Yes	Yes	
1.7 7. Limb Ataxia				
1.8 8. Sensory				
1.9 9. Language				
1.10 10. Speech			Yes	
1.11 11. Neglect			Yes	

C-STAT

**Cincinnati Prehospital Stroke Severity Scale
(CPSSS)**

C-STAT Assessment for LVO

Item	Findings	Score
Gaze	Absent	0
	Present	2
Arm Weakness	Absent	0
	Present	1
Level of consciousness (Confusion)	Absent	0
	Present	1
C-STAT Positive		2 or greater

C-STAT Performance on Detection of LVO

	Sensitivity	Specificity	Positive Likelihood Ratio	Negative Likelihood Ratio
Severe Stroke	89%	73%	3.3	0.15
Moderate Stroke	75%	85%	5.00	0.29

Katz: Stroke 2015;46:1508-1512

Conjugate Eye Deviation in Acute Stroke

Conjugate Eye Deviation in Acute Stroke Incidence, Hemispheric Asymmetry, and Lesion Pattern

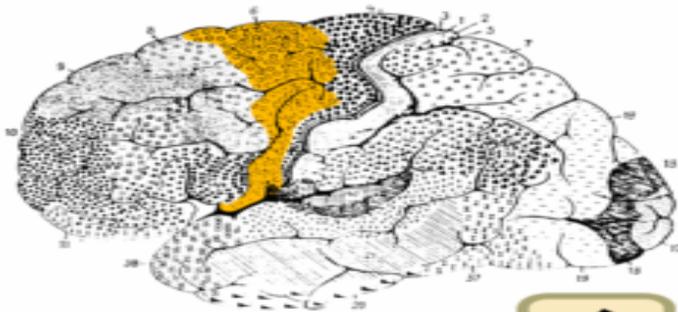
Oliver C. Singer, MD; Marek C. Humpich, MD; Helmut Laufs, MD; Heiner Lanfermann, MD;
Helmuth Steinmetz, MD; Tobias Neumann-Haefelin, MD

Stroke. 2006;37:2726-2732

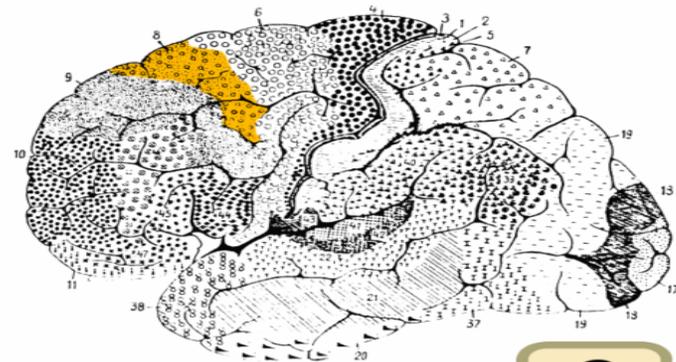
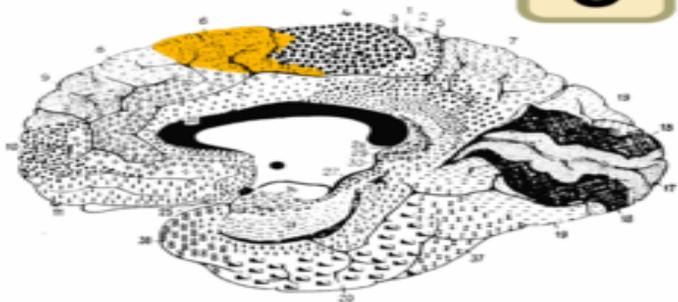
Dysconjugate Gaze



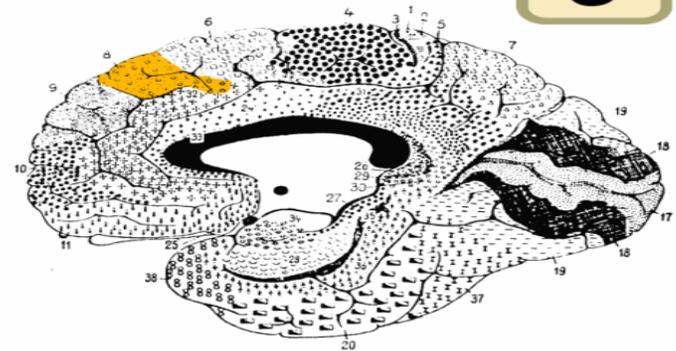
Conjugate Eye Findings in Stroke



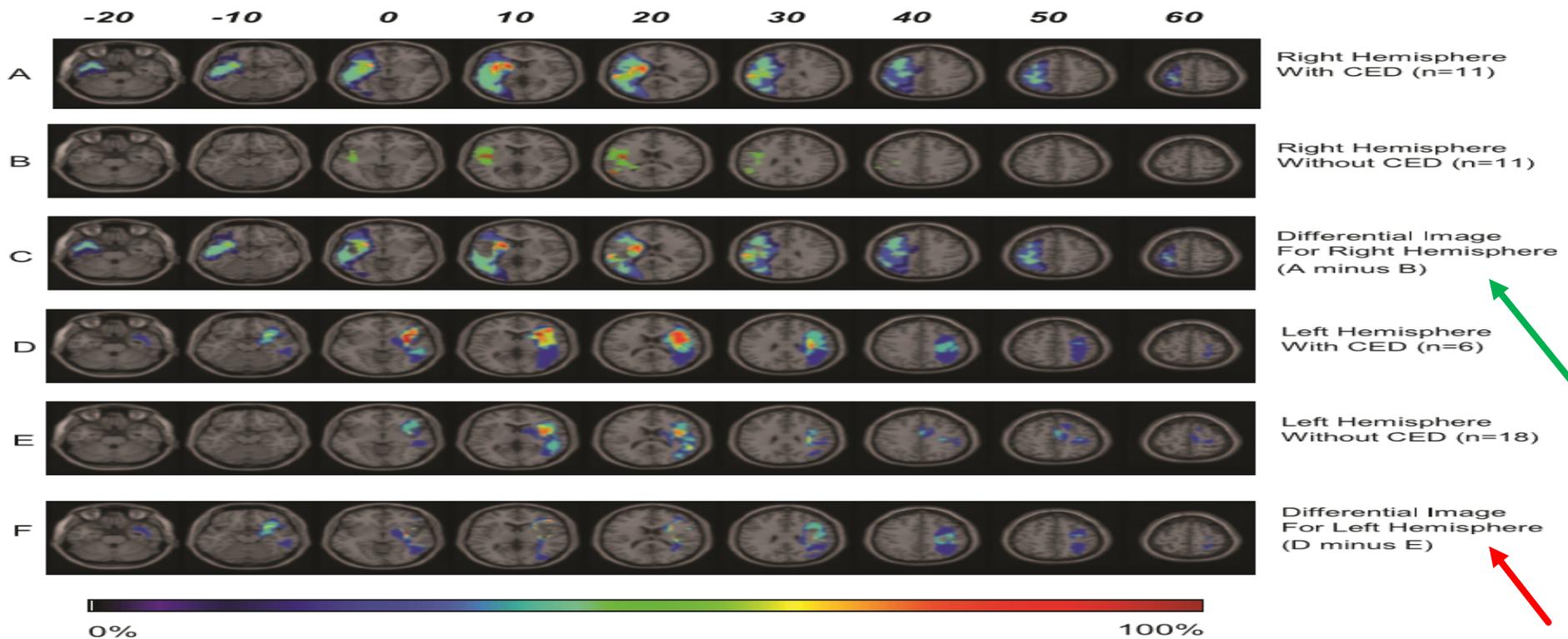
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8

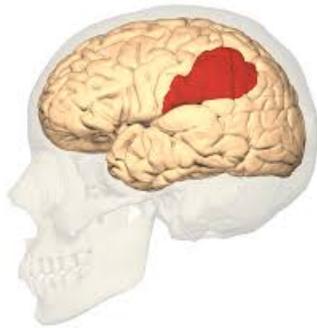


Conjugate Eye Deviation in Acute Stroke MRI Results

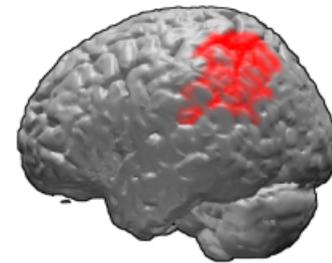


BA 39 and 40

BRODMANN 39 (APHASIA)



BRODMANN 40



31 SS (aka LAG Score)

3I-SS (LAG Score)

Item	Severity	Score
Disturbances of consciousness	No	0
	Mild	1
	Severe	2
Gaze / Head deviation	Absent	0
	Incomplete	1
	Forced	2
Hemiparesis	Absent	0
	Moderate	1
	Severe	2
Score (Total)		0-6

RACE Score
(Rapid Arterial Occlusion Evaluation scale.)

RACE

Category	Item	RACE Score	NIHSS Score
Facial Palsy.	Absent	0	0
	Mild	1	1
	Moderate to Severe	2	2-3
Arm Motor Function	Normal to mild	0	0-1
	Moderate	1	2
	Severe	2	3-4
Leg Motor Function	Normal to mild	0	0-1
	Moderate	1	2
	Severe	2	3-4
Head and Gaze Deviation	Absent	0	0
	Present	1	1-2

RACE

Category	Item	RACE	NIHSS
Aphasia	Performs Both Tasks Correctly	0	0
	Performs 1 task correctly	1	1
	Performs Neither Task	2	2
Agnosia	Patient recognizes his / her am and impairment	0	0
	Does not recognizes his / her am or impairment	1	1
	Does not recognizes his / her am and impairment	2	2

LA Motor Scale (LAMS)

LAMS

Category	Item	Score
Facial Droop	Absent	0
	Present	1
Arm Drift	Absent	0
	Drifts down	1
	Falls rapidly	2
Grip Strength	Normal	0
	Weak grip	1
	No grip	2

Summary of Clinical Triage Tools for LVO Strokes

	LAMS	3ISS (LAG)	RACE	C-STAT
Publication Year	2001	2005	2014	2015
Derivation N	119	171 Prospective	654	624
Goal of Scale	LVO	LVO Severe Stroke	LVO	Severe Stroke LVO
Independently validated	Yes (abstract)	No	Yes	Yes
Validation N			357	650
# Items to score	3	3	5 to 6	4
Time to complete	20-30 sec	20-30 sec	Variable	< 60 seconds
Sensitivity / Specificity Severe Stroke		NIHSS 14 (86%/95%)	NA	NIHSS 15 (89%/72%) / NIHSS 10 79%/89%
Sensitivity / Specificity LVO	81% / 89%	67%/92%	85%/65%	83%/40%
Evaluated EMS Setting	YES (FAST-MAG)	No	Yes	Yes

The Process of Selection of LVO Stroke Screen

- Regional Consensus
 - Stroke Centers
 - Interventional Stroke Centers
 - Primary Stroke Centers
 - EMS Medical Directors
 - Leadership of EMS agencies

Stroke: What is New?

Stroke Screening

- LA Prehospital Stroke Screen (LAPSS)
 - R/O stroke mimics (seizure, hypoglycemia, previous strokes)
- If LAPSS is positive, Perform C-STAT
 - Primary objective: Identify large vessel strokes.

How Good is EMS When We Activate Stroke Alerts?

MCEMS : Comprehensive Center Stroke Registry

- Stroke Registry from January 1, 2016 to November 30, 2016
 - All strokes admitted to XXX Hospital (CSC)
 - Total of 115 patients
 - 69/115 EMS Pre-alert
 - 57 Stroke /TIA 82%
 - 12 stroke mimic 18%

EMS "Non Alert"

- N=46
 - 13 EMS Dx of stroke but did not alert
 - 33 "NON ALERT" (True Negative 28%)
 - 23 / 33 ED Dx stroke or TIA
 - 10 / 19 ED did not diagnose stroke
 - When compared to ED, EMS did not alert in 23 / 115 (20% false negative rate)

Portland C-STAT Jan 1 to Jan 31, 2017

- 6 C-STAT positive stroke alerts
- 5/6 had LVO
- 1/6 had ICH

Preliminary conclusions

- True positives
 - 82% of the time
 - 18% mimics
- False negatives
 - 20% “false negatives” when compared with ED physician
- Promising data on Large Vessel stroke identification
 - 100% (6/6)

The END

Stroke Alert : Mimic (N=12)

Date of Service	EMS Dx	ED Dx	Final clinical diagnosis related to stroke:
1/1/2016	Yes	NO	Acute UTI
1/29/2016	Yes	NO	Renal failure (although worked up for stroke)
2/23/2016	Yes	NO	seizure disorder
2/25/2016	Yes	NO	Syncope
3/20/2016	Yes	NO	Convulsions
4/13/2016	Yes	YES	UTI /sepsis
5/5/2016	Yes	YES	Confusion/ seizure
5/14/2016	Yes	NO	Left-sided numbness
6/3/2016	Yes	NO	Left Arm paresthesia
8/19/2016	Yes	NO	Altered mentation
9/28/2016	Yes	YES	essential HTN
10/5/2016	Yes	NO	Sepsis/AMS

Stroke: No EMS Alert vs ED Dx=Stroke (N=23)

Date of Service	EMS Dx	ED Dx	Final clinical diagnosis related to stroke:
1/2/2016	vision problems	CVA	Ischemic Stroke
1/4/2016	neuro unspec.	Weakness, facial droop	Ischemic Stroke
1/13/2016	malaise	CVA	Ischemic Stroke
1/20/2016	headache	CVA	SAH
1/27/2016	neuro unspec.	CVA	Ischemic Stroke
1/29/2016	dizziness	CVA	Ischemic Stroke
1/29/2016	diabetes	TIA	TIA
2/3/2016	"sick person"	CVA	TIA
2/5/2016	alt. mentation	CVA	Ischemic Stroke
2/9/2016	weakness	CVA	Ischemic Stroke
3/28/2016	alt. mentation	CVA	ICH
4/8/2016	alt. mentation	CVA	Ischemic Stroke

Stroke: No EMS Alert vs ED Dx=Stroke_{con't}

Date of Service	EMS Dx	ED Dx	Final clinical diagnosis related to stroke:
4/23/2016	head injury	CVA	Ischemic Stroke
4/27/2016	vertigo	CVA	Ischemic Stroke
5/2/2016	trauma + neuro unspec.	CVA	Ischemic Stroke
5/6/2016	sepsis + neuro	CVA	ICH
5/7/2016	weakness/dizziness	CVA	Ischemic Stroke
5/28/2016	seizure	CVA	Mimic
6/10/2016	nd	CVA	TIA
8/8/2016	Gen. weakness	TIA	TIA
9/14/2016	Altered mentation	CVA	Ischemic Stroke
9/17/2016	neck pain	CVA	SAH
10/21/2016	Altered mentation	CVA	Ischemic Stroke

Stroke: No EMS alert vs ED Dx (N=10)

Date of Service	EMS Dx	ED Dx	Final clinical diagnosis related to stroke:
12/27/2015	malaise	Cerebellar mass	Ischemic Stroke
1/9/2016	Intractable pain	Facial Weakness	Ischemic Stroke
1/23/2016	alt. mentation	Syncope	Ischemic Stroke
2/5/2016	weakness	AMS, UTI	Ischemic Stroke
3/9/2016	near syncope	Acute Coronary Syndrome	TIA
3/22/2016	trauma	Gait instability	Ischemic Stroke
3/29/2016	trauma + neuro unspec.	Dehydration, AMS, Rhabdo (Acute/subacute infarcts in note, not in clinical impression.	Ischemic Stroke
3/29/2016	alt. mentation	SVT, encephalopathy	Ischemic Stroke
3/30/2016	neuro unspec.	R arm weakness/numbness	Ischemic Stroke
42668	dizziness	HTN emergency	Mimic