Stroke Update

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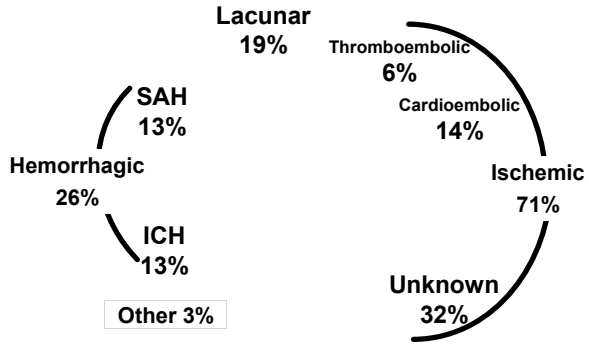
Objectives

- To provide a comprehensive approach to acute stroke management.
- To provide guidelines for IV, IA, combined IA-IV rt-PA, and mechanical thrombectomy.
- To provide a review of telestroke.

Stroke Facts

- Third leading cause of death
- A stroke occurs every 40 s in the USA
- Every 3.3 min someone dies from stroke
- Leading cause of adult disability
- Over 4 million stroke survivors

Stroke Subtypes



NINDS Stroke Data Bank:
Foulkes, et al. *Stroke* 1988;19:547.

Stroke Presentation

- Transient Ischemic Attack (TIA)
- Acute Ischemic Stroke

Transient Ischemic Attack

TIA

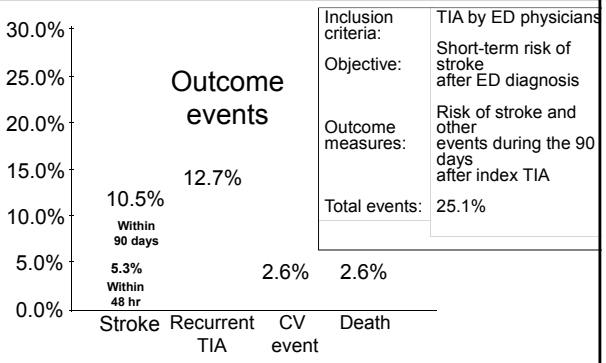
- Old definition: symptoms lasting <24 hr.
- New definition: Symptoms lasting < 1 hr.
- Majority of TIAs resolve within 60 minutes.
- Most TIA resolve within 30 minutes.

TIA and Stroke as Predictors of Secondary Stroke

	Post-TIA (%)	Post-Stroke (%)
30 days	4 – 8	3 – 10
1 year	12 – 13	5 – 14
5 years	24 – 29	25 – 40

Sacco. *Neurology* 1997;49(suppl 4):S39-S44.
Feinberg, et al. *Stroke* 1994;25:1320-1335.

Short-term Prognosis after ED Diagnosis of TIA



Johnston SC, et al. *JAMA* 2000;284:2901-2906.

TIA

- **Do we need to admit all TIA's ?**
- **What work up is enough to D/C from ER**

ABCD2 Score

Age older than 60 years	1 point
SBP ≥ 140 mm Hg	1 point
DBP ≥ 90 mm Hg	1 point
Unilateral weakness	2 points
Speech impairment without weakness	1 point
TIA duration ≥ 60 min	2 point
TIA duration 10-59 min	1 point
Diabetes	1 point

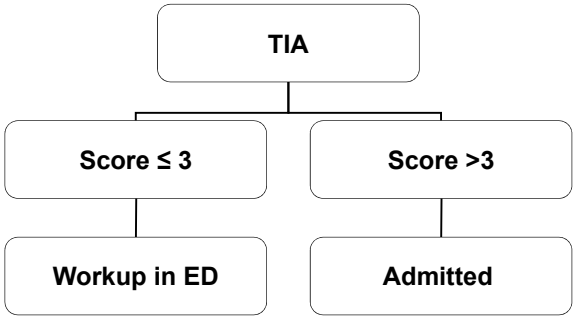
Johnston SC, et al. Lancet 2007; 369:283-92.

ABCD2 Risk stratification

Score	Stroke Risk		
	2 days	7 days	90 days
≤ 3	1%	1.2%	3.1%
4-5	4.1%	5.9%	9.8%
≥5	8.1%	11.7%	17.8%

Johnston SC, et al. Lancet 2007; 369:283-92.

ABCD2 and ED Management

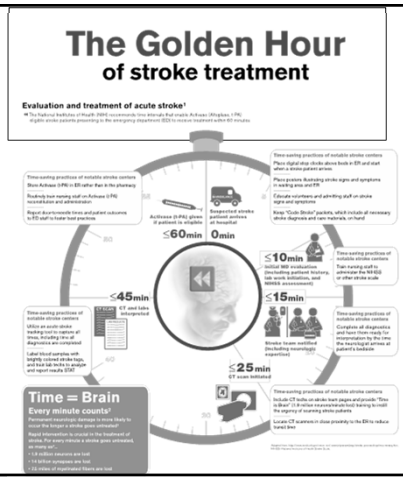


Johnston SC, et al. Lancet 2007; 369:283-92.

Ischemic Stroke

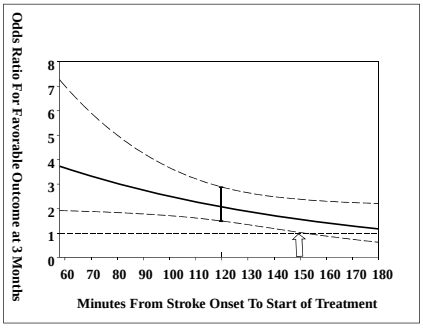
Acute Stroke Treatment

- IV rt-PA
- IA rt-PA
- Combined IV-IA rt-PA
- Mechanical Embolectomy



Stroke: Every Minute Counts

Early Rx was better in the NINDS tPA Trial



Marler JR, et al. Early stroke treatment associated with better outcome: The NINDS rt-PA Stroke Study. Neurology 55:1649-55, 2000.

Goal treatment timeline door-to-needle

- Evaluation by physician: 10 min
- Stroke expertise contacted:15 min
- Head CT or MRI performed: 25 min
- Interpretation of CT/MRI: 45 min
- Start of treatment: 60 min

Is the Golden Hour Achievable?

Limitations

- 21% of the US population lives in rural areas
- Significant shortage of physicians with expertise in acute stroke treatment
- Four neurologists per 100,000 persons
- Many neurologists have discontinued hospital privileges

rt-PA Experience

- A review of Medicare data for 4750 hospitals showed that only 2.4% of patients are treated with t-PA.
- 60% of hospitals reported no t-PA treatment.
  - Smaller hospitals <100 beds
  - Rural areas

Hess DC etal. Cerebrovascular Disease and Stroke. 2011, 13:215

Primary Stroke Centers

- More than 600 PSC across the US.
- Most located in metropolitan areas
- <25% of US population lives within 30 min of PSC
- Only half able to reach a PSC within 1 h if state boundaries respected by ground ambulance

Treatment of Stroke in rural area

- Ship and drip
- Drip and ship

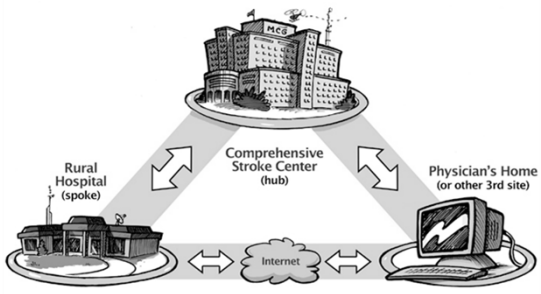
Ship and Drip Concept

- Patients initially assessed in rural hospital
- Transfer patients who are able to get to a PSC within 3 h
- This is feasible probably within 80 miles radius
- Not a desirable solution

Drip and Ship Concept

- Initial assessment in rural hospital
- Consultation with stroke expert through phone consultation or telestroke
- t-pa started then patient is transferred

Telestroke



IV rt-PA

- 0-3 h last known well
- 3-4.5 h last know well

IV rt-PA Eligibility 0-3 h

- Diagnosis of ischemic stroke
- Onset of symptoms < 180 min

Updated Contraindications to rt-PA

Clinical

- Symptoms suggestive of intracerebral hemorrhage or subarachnoid hemorrhage
- Persistent blood pressure elevation >185/110
- Active bleeding or acute trauma (fx)

Historical

- Intracranial or intraspinal surgery or serious head trauma in prior 3 months
- Presence of intracranial conditions that increase risk of bleeding (tumor, vascular malformations, ..)

Laboratory

- Bleeding diathesis

Other Relative Contraindications

- Seizure at onset of stroke
- Serum glucose <50 mg/dl or >400 mg/dl
- Hemorrhagic eye disorders
- Myocardial infarction in the prior six weeks
- Suspected septic embolism
- Infective endocarditis

Radiological

- Evidence of hemorrhage
- Major early infarct signs
  - Diffuse swelling of affected hemisphere
  - Parenchymal hypodensity
  - Effacement of >33% of middle cerebral artery territory

NINDS rt-PA Stroke Study

- **Prospective, randomized, double-blind trial**
- **624 patients: half treated within 90 minutes, half treated within 91 to 180 minutes**
- **rt-PA dose: 0.9 mg/kg, maximum dose: 90 mg, 10% as IV bolus, remainder via 1-hour infusion**
- **Careful attention to Bp: <185/110**
- **No anticoagulant or antiplatelet agents for 24 hours**

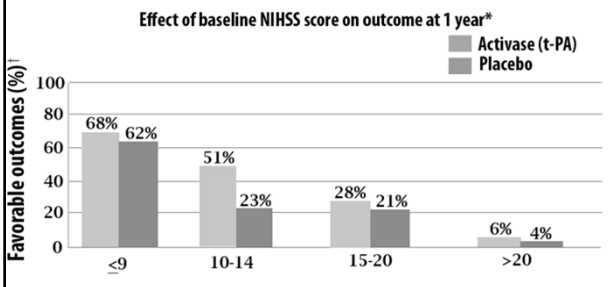
IV rt-PA and Outcome

Discharge dispositions from initial hospitalization in the NINDS study

	t-PA (n=312)	Placebo (n=312)
Home	48%	36%
Inpatient rehabilitation unit	29%	37%
Nursing Home	7%	13%
Other facility	4%	2%
Dead	11%	13%

Fagan SC etal. Neurology 1998;50:883

Baseline symptoms and outcome



Kwiatkowski TG et al. N Engl J Med. 1999;340:1781

rt-PA Complications

- **In a meta-analysis of 15 published studies rate of ICH was 5.2% in 3 month**
- **Increase rate of hemorrhage was associated with protocol deviations.**

Adapted from Graham GD. Stroke, 2003;34:2487; Katzan IL etal. Stroke, 2003;34:799; Wahlgren N etal. Lancet, 2007;369:275

3 TO 4 ½ HOURS

- 821 patients
- 18 to 80 years old randomized to tPA vs placebo
  - 52% no disability with tPA vs 45% placebo
  - No mortality difference (7.7% tPA vs 8.4%)
  - Symptomatic hemorrhage 7.9% tPA vs 3.5%

ECASS III: NEJM 2008;359:1317-29

Contraindications to tPA 3 - 4.5 hours

- Patients older than 80 years
- Patients taking oral anticoagulants regardless of INR
- Patients with baseline NIHSS >25
- Patients with history of diabetes and stroke

IV t-PA should be administered to eligible patients who can be treated in the time period of 3 to 4.5 hours after stroke (Class I Recommendation, Level of Evidence B).

Science Advisory from AHA. Stroke 2009,40:2056

Conclusion

- Acute stroke is analogous to trauma:
  - Patients should be quickly assessed and screened for t-PA
  - Stroke expertise should be at the bedside either physically or through telemedicine approach

Stroke Update

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Disclosures

- None

Quick facts

- Ischemic stroke over 700,000 patients annually in the United States
- Leading cause of combined morbidity and mortality in the western hemisphere
- Most common etiologies
  - large-artery atherosclerosis (20– 30%)
  - cardiac (20– 30%)
  - small-vessel or lacunar stroke (20– 30%)

Endovascular thrombectomy

- 5 randomized clinical trials demonstrated that mechanical thrombectomy of large vessel occlusion strokes improved neurological outcomes compared to maximal medical therapy
- Previously, the only class I data to support therapy in acute ischemic stroke was IV rTPA published in 1995 – 20 years ago!

Decompressive hemicraniectomy

- In patients who suffer large middle cerebral artery ischemic stroke, 3 European randomized clinical trials (HAMLET, DECIMAL and DESTINY) demonstrated
  - decreased mortality
  - improved neurological outcomes in pooled analysis

Endovascular thrombectomy

ESCAPE	EXTEND IA	MR CLEAN	REVISCAT	SWIFT PRIME
Alberta	Australia	Netherlands	Spain	USA

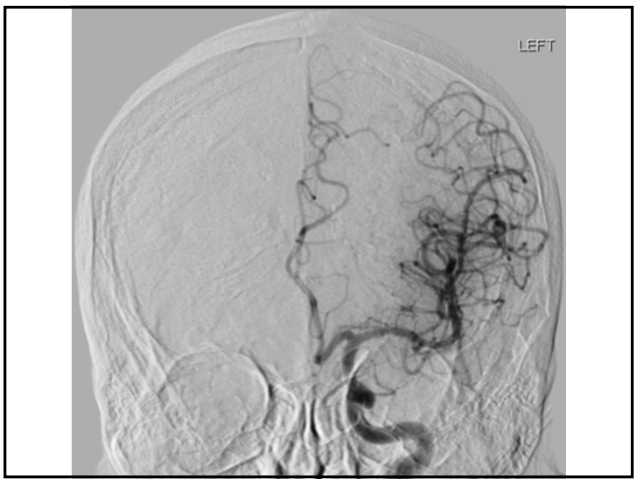
Improvement in neurological outcomes at 90 days

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

Thrombectomy technique

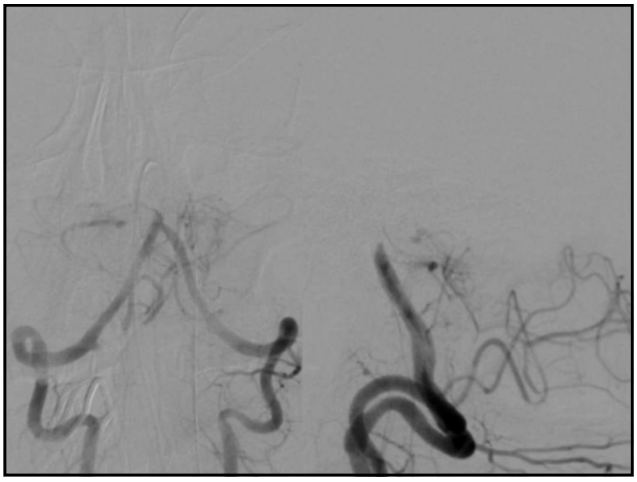
Case

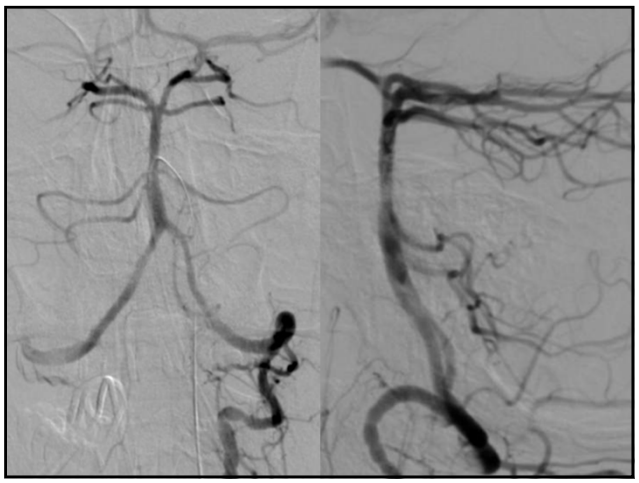
- **75-year-old female with multiple medical problems presented to local hospital with right hemiparesis and aphasia**
- **Patient received IV rTPA and transferred to OSU**
- **CTA demonstrated left M1 occlusion**



Case

- 30-year-old female presented with left facial droop and subtle left weakness
- Her exam deteriorated to somnolence and unable to follow commands
- CT brain demonstrated no hemorrhage
- CTA brain concerning for basilar occlusion





Decompressive hemicraniectomy

Case

- 63-year-old male presented with right-sided weakness and aphasia
- CT demonstrated no hemorrhage
- CTA demonstrated no large vessel occlusion
- 30 hours after presentation, patient become somnolent