Acute Management of Stroke

Michel T. Torbey, MD, MPH, FAHA, FCCM
Professor, Neurology and Neurosurgery
Medical Director, OSU Stroke and Neurovascular Center
The Ohio State University College of Medicine

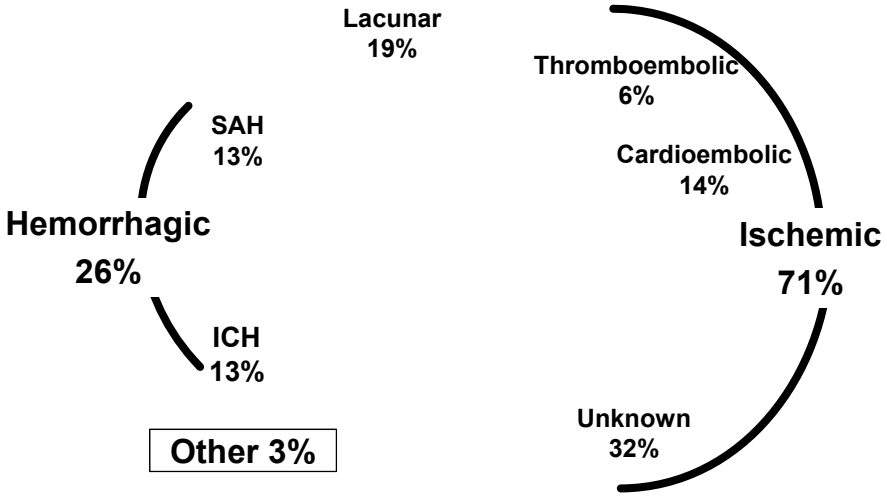
Objectives

- 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

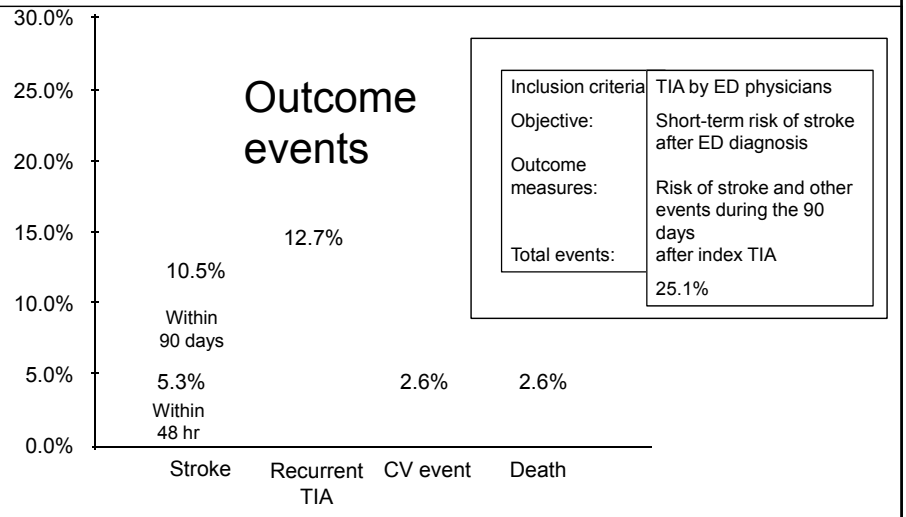
- **Old definition: symptoms lasting <24 hr.**
- **New definition: Symptoms lasting < 1 hr.**
- **Majority of TIAs resolve within 60 minutes.**
- **Most TIA resolve within 30 minutes.**

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

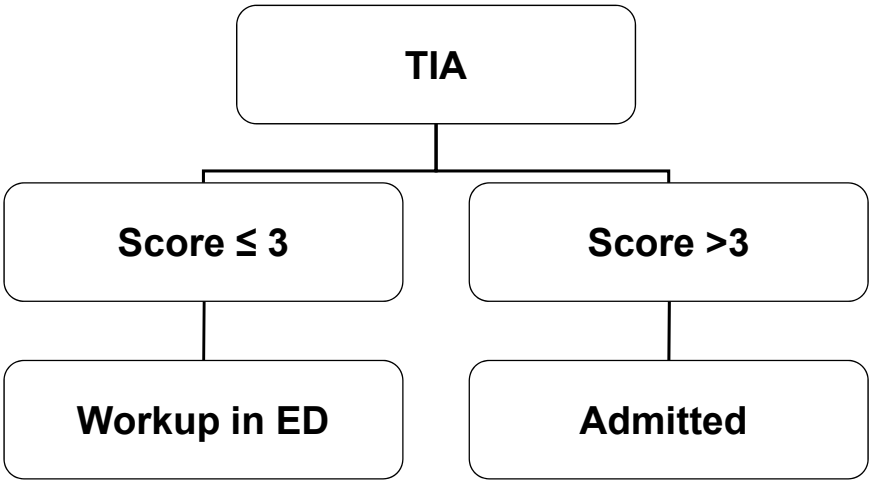
Johnston SC, et al. Lancet 2007; 369:283-92.

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



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TIA Workup in ED

Initial evaluation	AHA recommendations (1999 and 2006)[29,41]	National Stroke Association (2006)[47]
Timing	'Prompt'	Prompt (within 24–48 h); same day access to imaging
Hospitalization	No recommendation	Should be considered to facilitate early therapy and secondary prevention
Laboratory testing	Full blood and platelet count with chemistry profile (fasting cholesterol, prothrombin time, activated partial thromboplastin time, erythrocyte sedimentation rate, syphilis serology)	Full blood count, serum electrolytes, creatinine, fasting blood glucose and lipid levels
Electrocardiography	Recommended	Recommended
Brain imaging study	CT scan; routine MRI not recommended	CT or MRI
Vascular imaging	Ultrasonography, MR or CT angiography	Carotid imaging, CT or MR angiography, or transcranial Doppler

Nguyen-Hunynh M, Johnston SC, . Nature 2007; 4(6):310.

Ischemic Stroke

Acute Stroke Treatment

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

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

Contraindications to rt-PA

Clinical

- Symptoms/signs only minor or rapidly improving
- Seizure at onset of stroke (not absolute)
- Symptoms suggestive of subarachnoid hemorrhage
- Persistent blood pressure elevation >185/110
- Active bleeding or acute trauma (fx)

Historical

- Stroke or head trauma in prior 3 months
- Any history intracranial hemorrhage
- Major surgery in previous 14 days
- GI or GU tract bleeding in previous 21 d
- Arterial puncture at non-compressible site previous 7 days

Laboratory

- Platelets less than 100K
- On oral anticoagulant with INR > 1.7
- On heparin with PTT higher than normal

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**

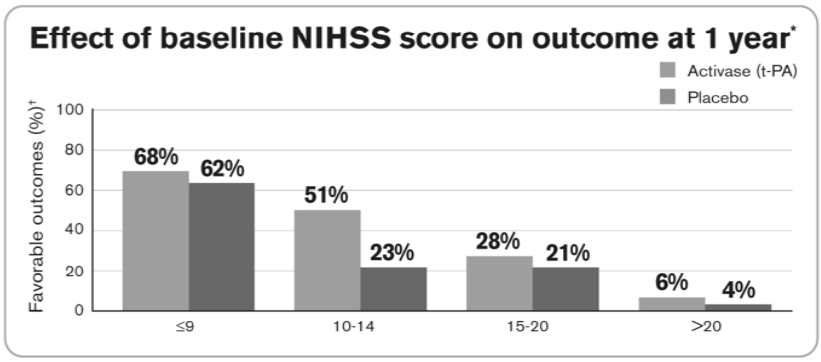
IV rt-PA and Outcome

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).

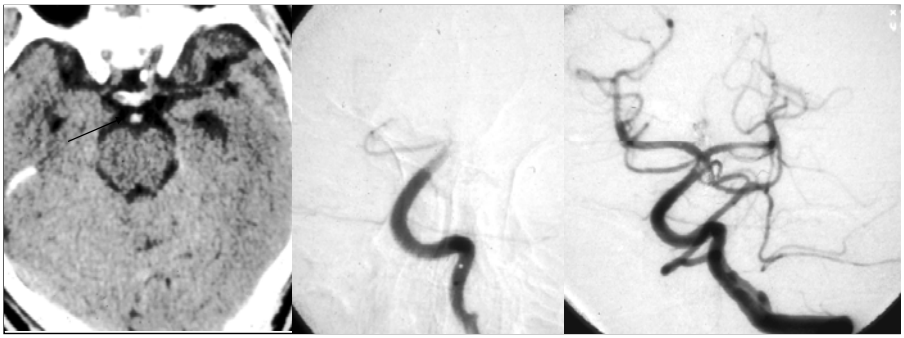
Science Advisory from AHA. Stroke 2009,40:2056

IA rt-PA

0-6 hrs

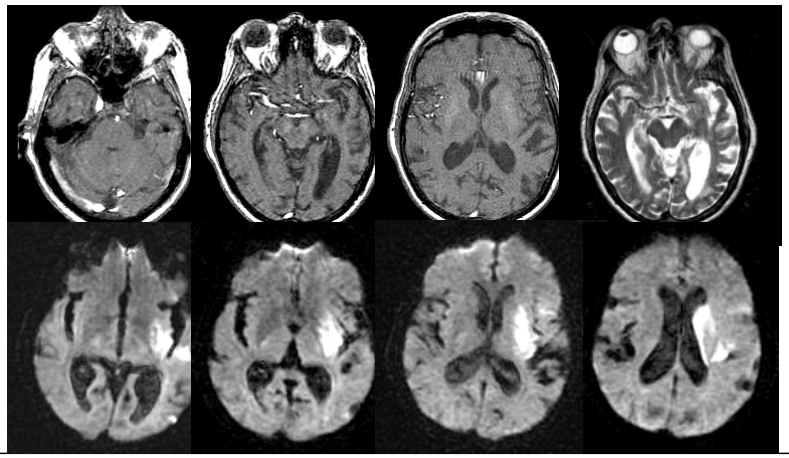
STROKE: IA THROMBOLYSIS

68 y.o. male with sudden loss of consciousness, fluctuating diplopia, and paresthesias. Basilar artery ischemic stroke. Emergent thrombolysis resulted in reperfusion and good clinical outcome.



STROKE: IA THROMBOLYSIS

78 y.o. female with sudden onset of left hemiparesis and aphasia. Acute left MCA occlusion. IV t-PA thrombolysis resulted in immediate improvement. Deterioration 12 hours later. IA reperfusion and L ICA stenting. Good clinical outcome.



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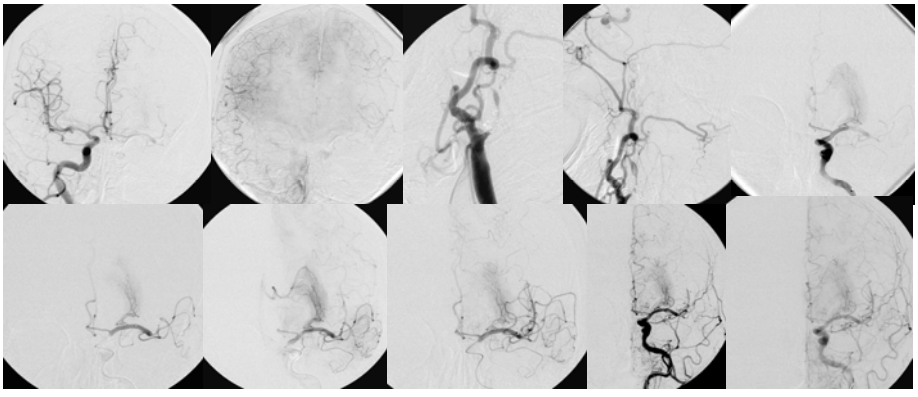

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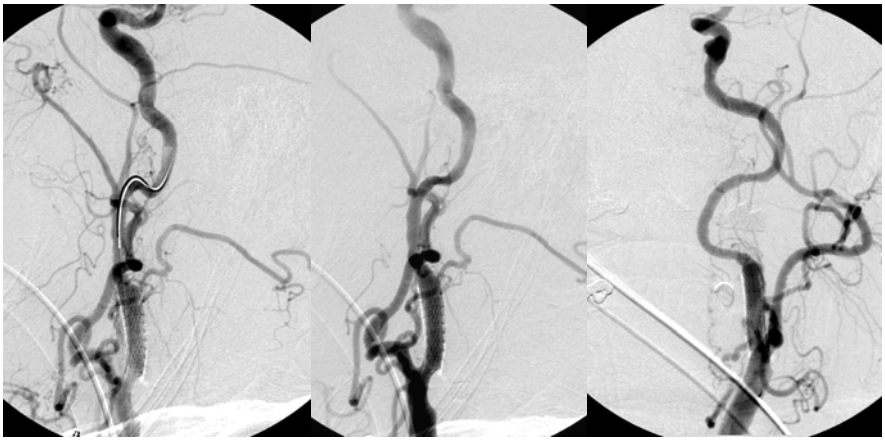
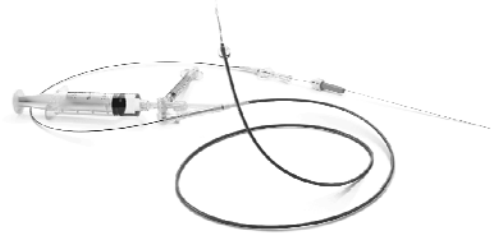
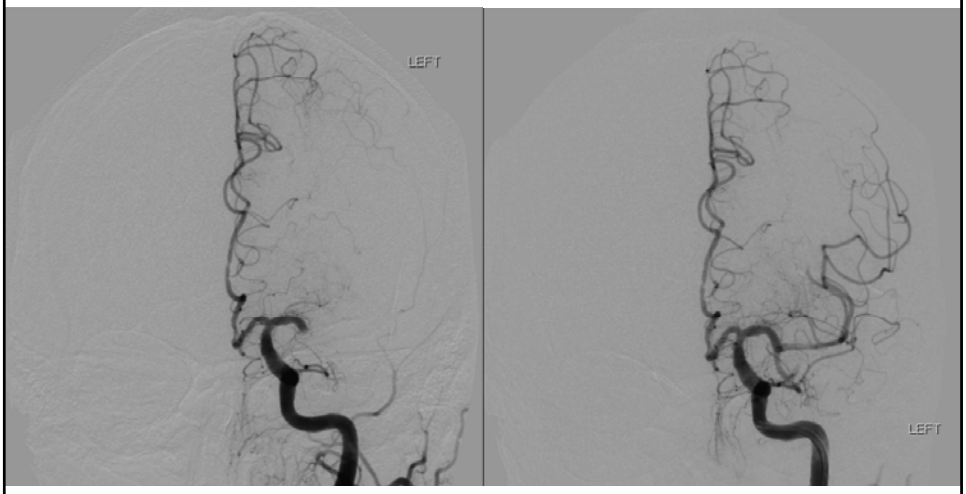


Thrombectomy for Stroke 0-8 hrs



Thrombectomy for Stroke



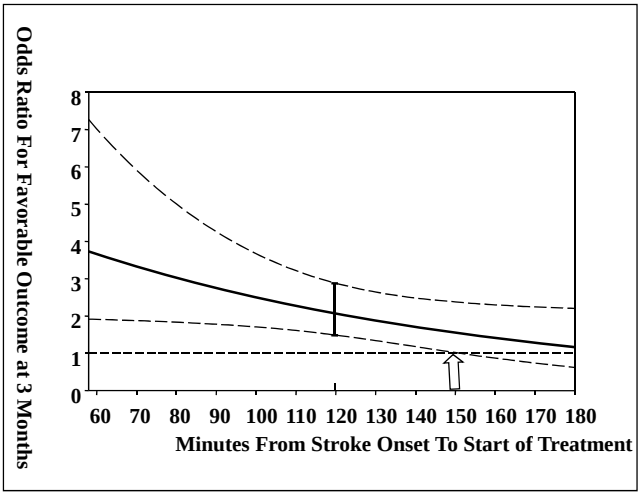
Recanalization (restoring flow) rates by intervention

- Spontaneous: 24.1%
- Intravenous thrombolysis: 46.2%
- Intra-arterial thrombolysis: 63.2%
- Combined IV and IA thrombolysis: 67.5%
- Mechanical: 83.6%

Rha et al: The impact of recanalization in ischemic stroke outcome: a meta-analysis. Stroke 2007: 38:967

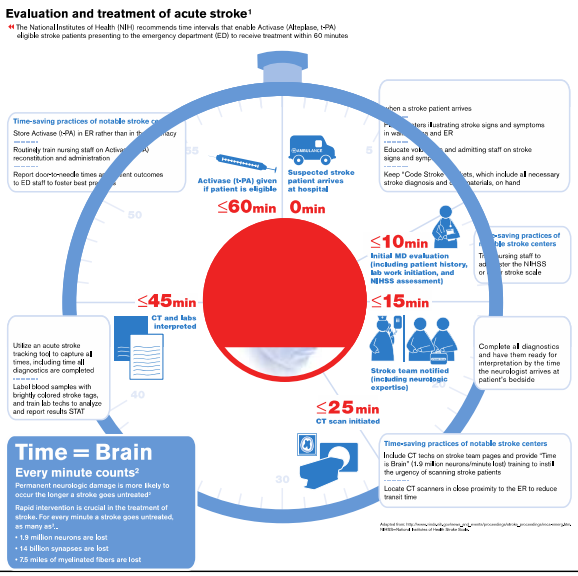
Stroke: Every Minute Counts

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.

The Golden Hour
of stroke treatment



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

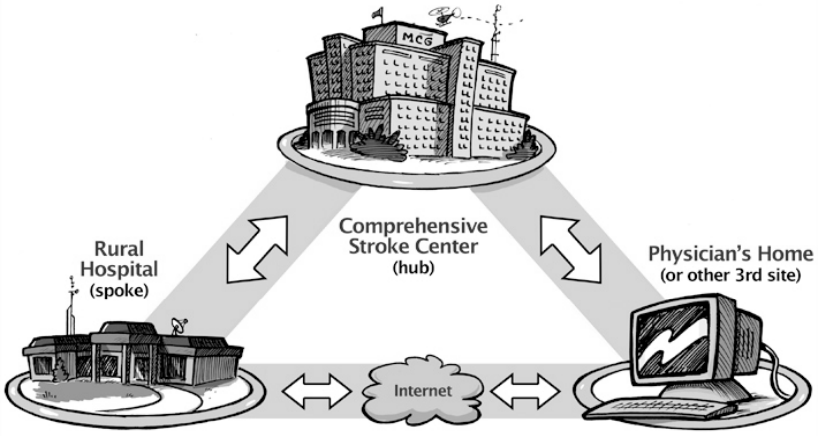
Ship and Drip Concept

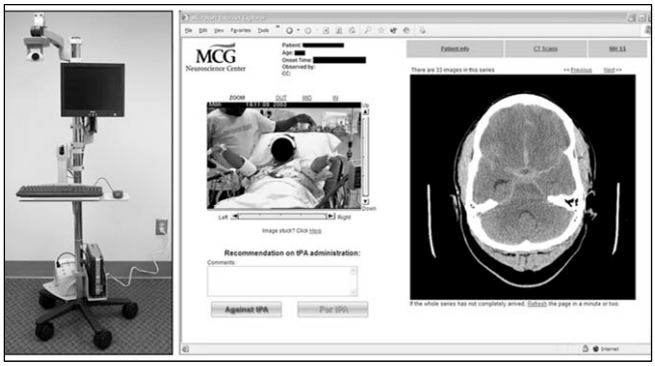
- Patients initially assessed in rural hospital
- Transfer patients who are able to get to a PSC within 3 h
- This is feasible probably within 80 miles radius
- Not a desirable solution

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





How can we do a neuro exam on camera?

- **NIHSS done through video connection by as a stroke specialist is as good as bedside evaluation. (Class I, Level of Evidence A).**

Telemedicine and telephone consultation

- Several successful demonstrations published
- 234 patients assessed prospectively and randomised to telemedicine vs telephone consultation
- Correct treatment decisions were made more often in the telemedicine group than in the telephone group [98%] vs [82%]
- IV thrombolytics were used at an overall rate of 25% ([28%] telemedicine vs [23%] telephone,

Telestroke in practice

"Now inhale deeply, Mrs. Saunders."

AHA Recommendations Telephone Consultation

- **Compared with traditional bedside evaluation and use of IV tPA, the safety and efficacy of IV tPA administration based solely on telephone consultation without CT interpretation via teleradiology is not well established (Class IIb, Level of Evidence C).**

AHA Recommendations Telestroke

- **It is recommended that a stroke specialist using video conferencing provide medical opinion in favor of or against the use of IV tPA in patients with suspected acute ischemic stroke when on-site expertise is not immediately available (Class I, Level of Evidence B)**

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**