

# Emergent Management of Acute Ischemic Stroke

Michael J. Schneck, MD

Dept. of Neurology & Neurosurgery

Loyola University Medical Center

# Stroke Incidence and Prevalence in the United States

- Incidence<sup>1</sup>
  - 795000 strokes/year in US (new or recurrent)
  - 300,00 TIA/year in the US
    - 1 stroke every 45 seconds
- Prevalence<sup>1</sup>
  - 4.7 million cases
  - leading cause of disability
  - 2million stroke survivors
- Estimated direct and indirect costs exceeds \$7 billion/year
  - Quoted cost per person ~\$50,000 per year
- Incidence differs among ethnic populations, gender, and geography
- Risk increases strongly with age

# Assessment of Acute Stroke



Theobald Chartran, 19th Century  
National Library of Medicine

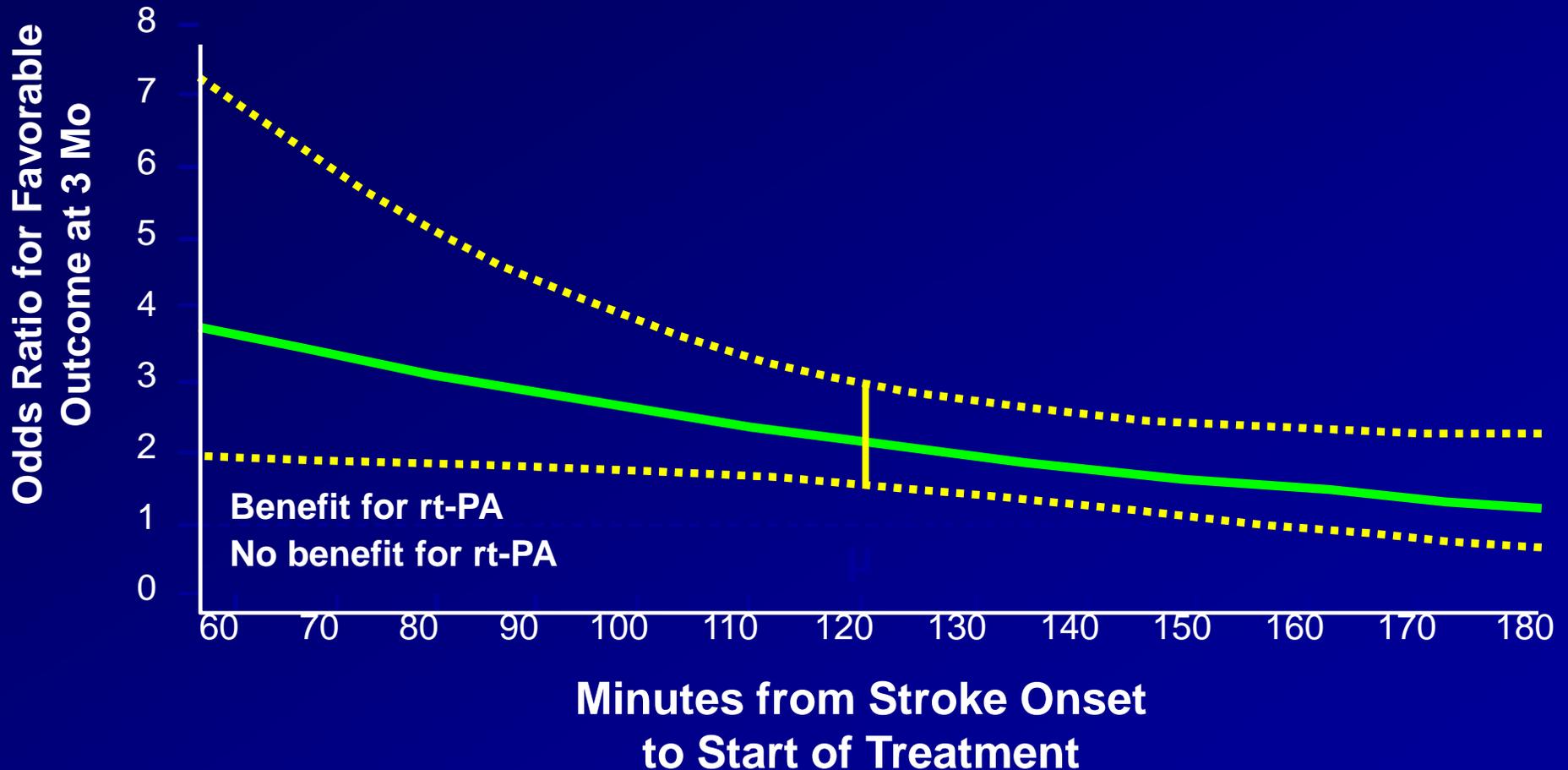
# Goals of the Work-Up

- Stabilize patient/reverse stroke
  - thrombolysis when appropriate
- Prevent peristroke complications
  - DVT, pneumonia, cerebral edema
- Determine location of stroke
- Define mechanism of stroke
- Secondary prevention (prevent recurrence)

# Stroke Evaluation Targets For Potential Thrombolysis Candidates *NINDS Recommendations*

<i>Time Interval</i>	<i>Time Target</i>
Door to Door	10 minutes
Access to neurological expertise	15 minutes
Door to CT completion	25 minutes
Door to CT interpretation	45 minutes
Door to treatment	60 minutes
Door to monitored bed	3 hours

# Time Is Brain: Effects of tPA vs Time



# NIH Stroke Scale

(see AHA website for training modules)

■ Consciousness	0-3	■ Orientation	0-2
■ Commands	0-2	■ Gaze limits	0-2
■ Visual fields	0-3	■ Facial paresis	0-3
■ Arm motor (R)	0-4	■ Leg motor (R)	0-4
■ Arm motor (L)	0-4	■ Leg motor (L)	0-4
■ Limb ataxia	0-2	■ Dysarthria	0-2
■ Language	0-3	■ Sensory deficits	0-2
■ Neglect	0-2		

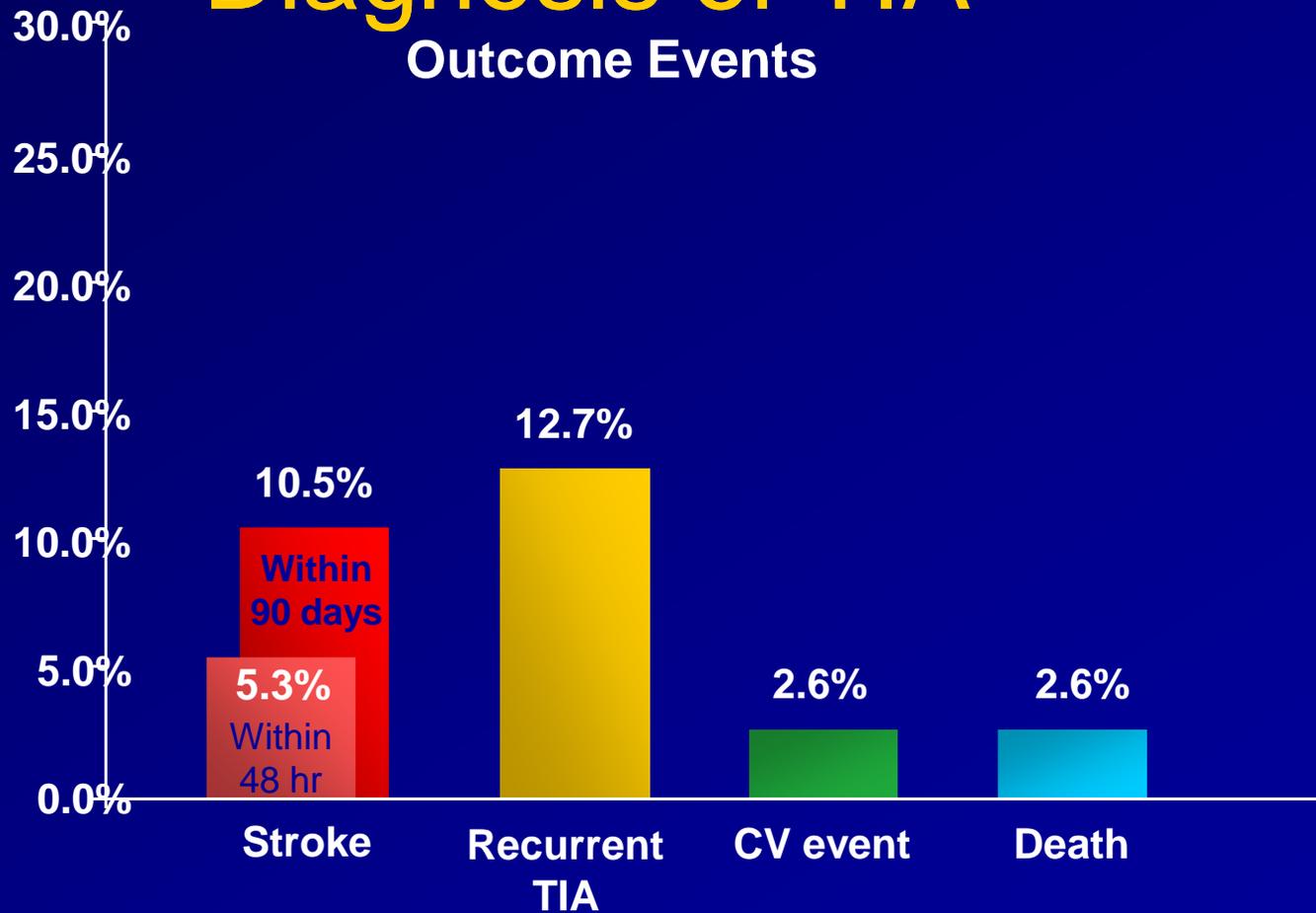
# Transient ischemic attack (TIA):

transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction.

Patients with suspected TIA should rapidly undergo:

1. Neuroimaging evaluation within 24 hours of symptom onset
  - MRI, including DWI, is preferred
  - If MRI is not available, perform CT
2. Noninvasive imaging of the cervicocephalic vessels
3. Noninvasive testing of the intracranial vasculature to exclude the presence of intracranial stenosis
4. Evaluation as soon as possible after an event.

# Short-Term Prognosis after Emergency Department Diagnosis of TIA

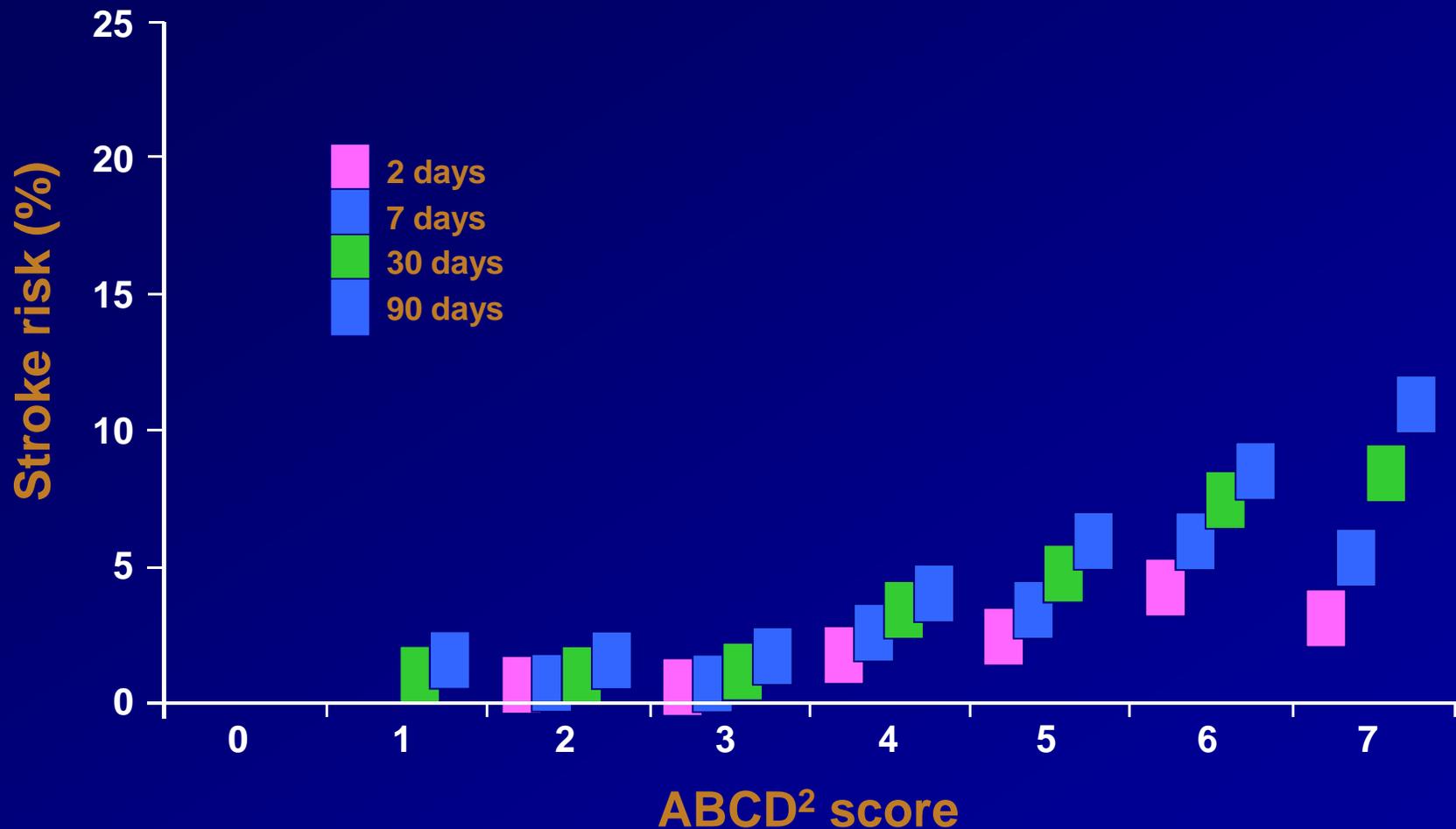


# ABCD<sup>2</sup> Score

Symptom	Score
Age ≥60 years	1 point
Blood pressure ≥140/90 mm Hg	1 point
Clinical features [of TIA]	2 points for unilateral weakness 1 point for speech impairment without weakness
Duration [of TIA]	2 points for ≥60 minutes 1 point for 10-59 minutes
Diabetes	1 point

Maximum score is 7. Score 6 or 7 = high risk.

# Stroke Risk by ABCD<sup>2</sup> Score



# Limits of the ABCD Score

- Prospective study of 117 patients
  - 26 classified as high risk
    - (stroke or death within 90 d).
    - Frequency of high risk increased with ABCD score
  - Of those who had an MRI 15/61 (25%) had positive DWI lesions.
    - Correlation with ABCD score was poor with between 10-36% of patients in the 0-4 categories having positive lesions.
      - for patients with score of 5: 13%
      - for patients with score of 6: 60%
      - p value of trend= 0.24

Cucchiara B Stroke 2006

# Limits of the ABCD Score (2)

- Study in Calgary, Alberta, Canada
- 69 patients with TIA and 51 patients with minor stroke.
- Risk of new stroke at 90 days
  - 32.6% with DWI and vessel occlusion
  - 10.8% with DWI and no occlusion
  - 4.3% with no positive DWI lesions

Coutts SB et al Ann Neurol 2005

# Advances in Radiologic Diagnosis

If there is no knowledge there is no understanding;

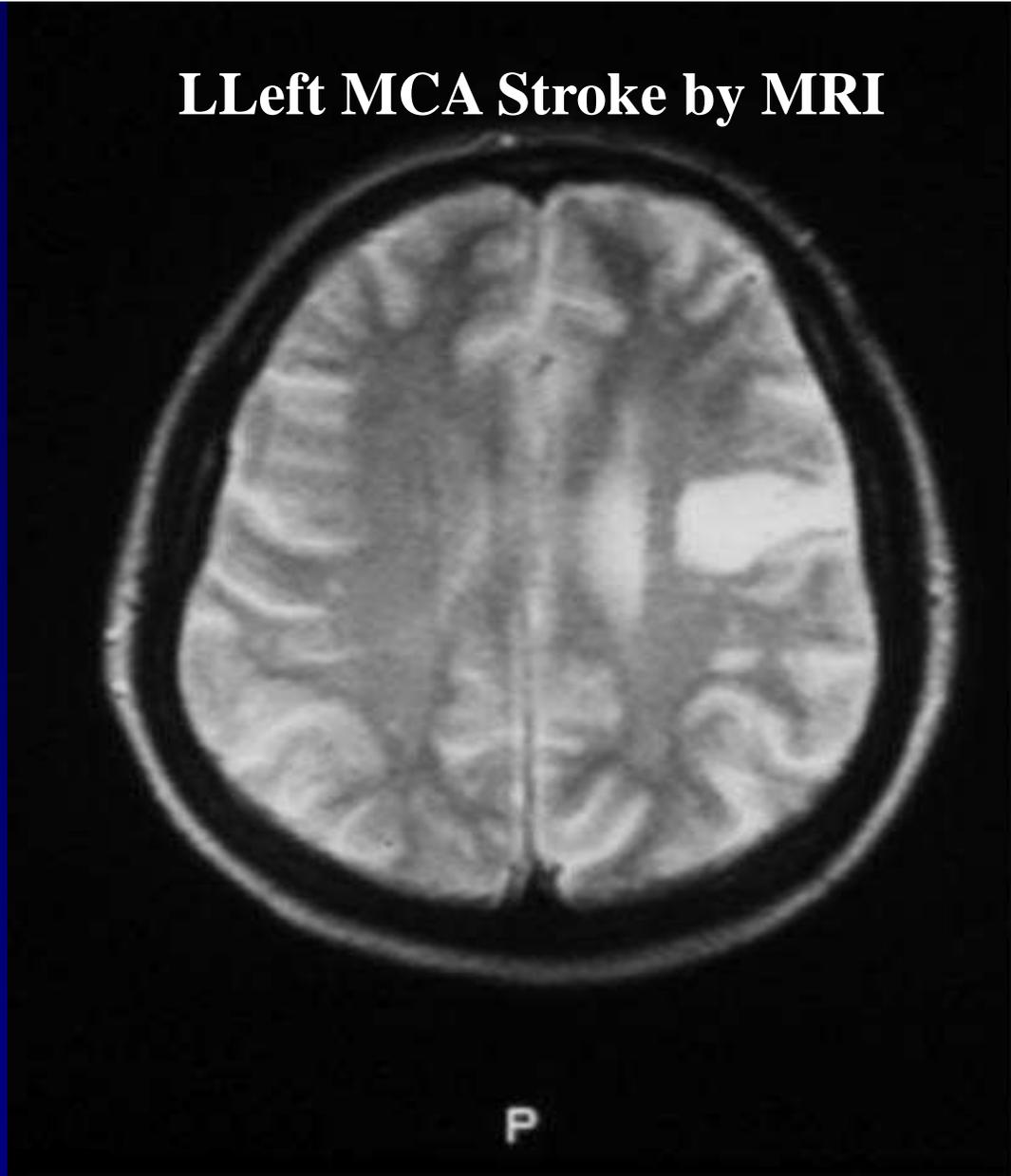
if there is no understanding there is no knowledge.

Pirkei Avot Chapter 3



**1. Early changes with loss of sulci and edema on the right side**

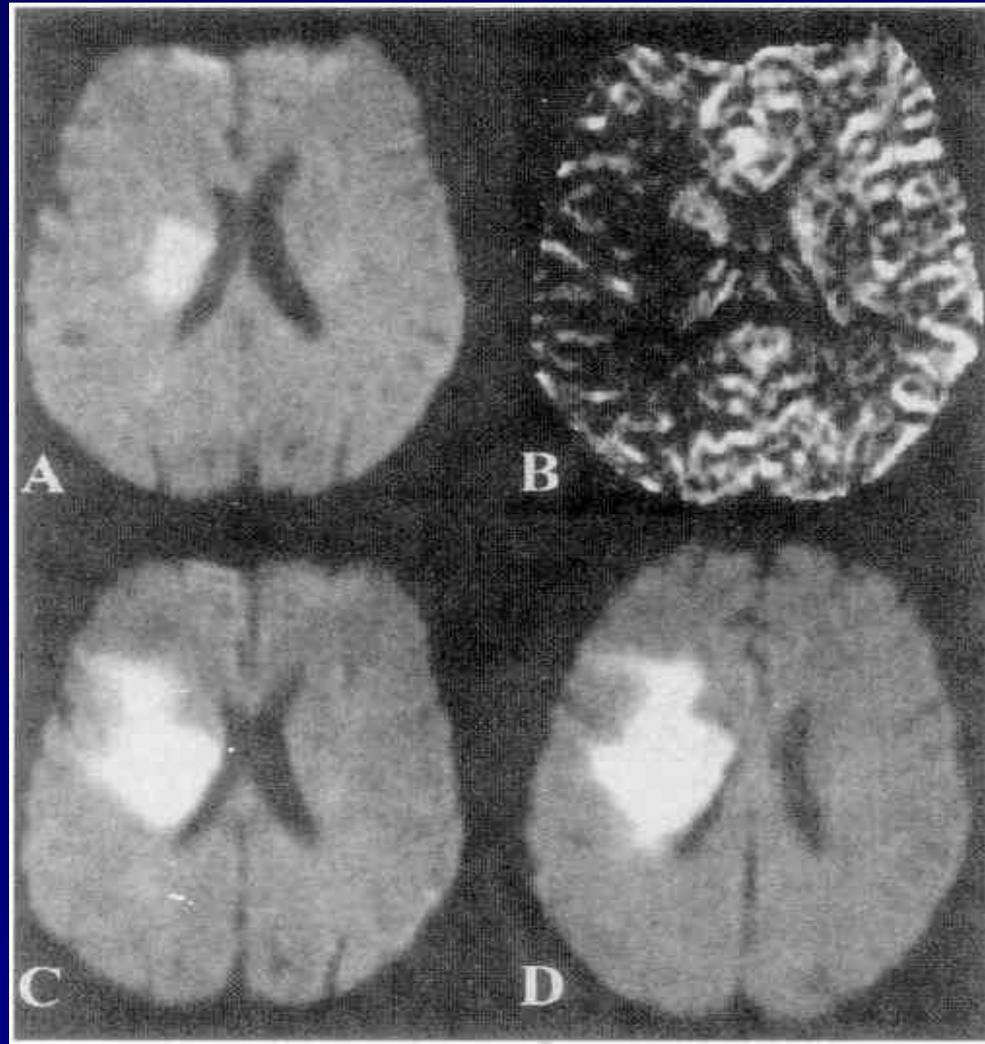
## **LLeft MCA Stroke by MRI**



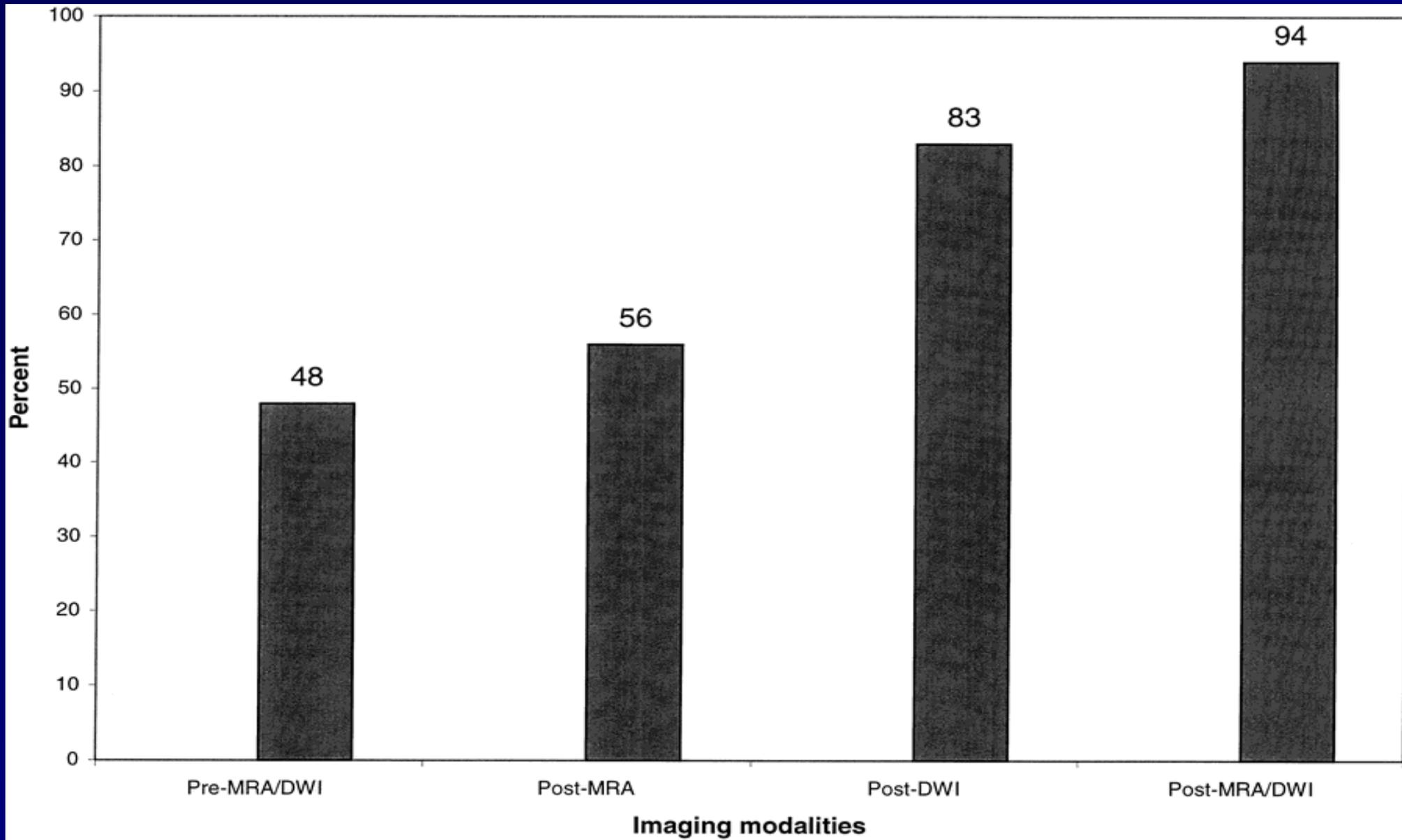
**T2 weighted image of a left cortical infarct**

# Diffusion & Perfusion Weighted MR imaging

- Allows for early identification of ischemic changes.
  - Can show tissue at risk for infarction
- Measures early changes in blood flow and changes in water content
- Becoming more widespread but overall utility?
  - Immediate CT still mainstay of diagnosis

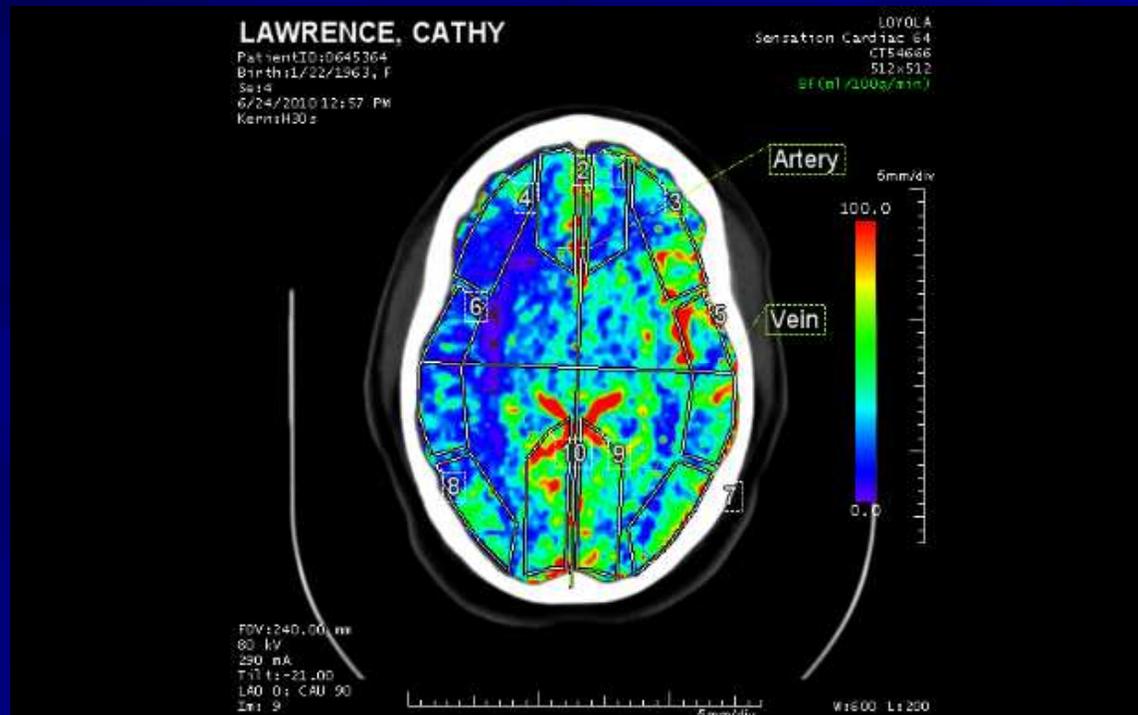


**Evolution of infarct size over time by DWI (A,C, D)  
B represents the related perfusion image.**



**From the UCLA group: The advantages of MRA and DWI in diagnosis of stroke**

# CT Perfusion



A large area of CT perfusion deficit as a result of new right cerebral ischemia

# Management



# NINDS rt-PA Acute Stroke Study

- 30% more likely to have little or no deficit at 90 days
  - NNT: 1 stroke prevented for every 8 treated  
(a very strong ratio for drug therapies)
- Symptomatic ICH = 6.4% vs. 0.6% controls
  - Despite this, no overall increase in mortality with rt-PA *and* overall benefit factored in hemorrhagic complications!

NEJM 1995; 333: 1581-7

# TPA in Clinical Practice

- Only 3%-4% of stroke patients receive tPA
  - mostly due to time delays
- In real world, results achievable that are similar to NINDS trial
  - Rate of ICH: 4%-6%
- Risk of ICH increases with protocol violations
  - Time >3 hours
  - Poor blood pressure control
  - Use of 'prohibited meds'
  - Wrong dose
    - 0.9 mg/kg
    - Maximum dose: 90 mg
  - Elevated blood sugar also increases risk
- Cleveland experience shows that staying with the protocol improves outcome.

# Overall Benefits and Risks of IV tPA for Stroke

- Benefit: neurologically normal at 3 months
  - 55% relative increase
  - 12% *absolute increase*
- Very robust effect:
  - NNT for neurologically normal: 8
  - NNT for improvement on mRS: 3.1
- Risk of symptomatic ICH was 6.4%
- The overall benefits *include* the ICHs
- Risk of ICH can be reduced by closely following the tPA protocol

mRS, modified Rankin scale.

NINDS rt-PA Stroke Study Group. *N Engl J Med.* 1995;333:1581-1587.

Adams HP Jr, et al. *Stroke.* 2003;34:1056-1083.

Saver JL. *Arch Neurol.* 2004;61:1066-1070.

# ATLANTIS

- 3-5 hour window
- negative for the endpoints of modified Rankin Scores of (0,1) or (0,1, and 2)
- Several other post-marketing studies have shown similar results to NINDS from 0-3 hours
  - NOTE: Cleveland experience proves need to follow protocol
    - Large numbers of complications as a result of ‘protocol’ violations’

# TPA 3 - 4.5 hours

- N=821: 418 to the alteplase group and 403 to the placebo group.
  - Median time for the administration of alteplase was 3 hours 59 minutes.
  - 0.9 mg per kilogram of body weight or placebo.
- The primary end point was disability at 90 days, dichotomized as a favorable outcome (a score of 0 or 1 vs 2-6 on mRS scale)
  - The secondary end point was a global outcome analysis of four neurologic and disability scores combined.
  - Safety end points included death, symptomatic intracranial hemorrhage, and other serious adverse events.

# TPA 3 - 4.5 hours

- More patients had a favorable outcome with alteplase than with placebo (52.4% vs. 45.2%; odds ratio, 1.34; 95% confidence interval [CI], 1.02 to 1.76;  $P=0.04$ ).
  - In the global analysis, the outcome was also improved with alteplase as compared with placebo (odds ratio, 1.28; 95% CI, 1.00 to 1.65;  $P<0.05$ ).
  - The incidence of intracranial hemorrhage was higher with alteplase than with placebo (for any intracranial hemorrhage, 27.0% vs. 17.6%;  $P=0.001$ ;
    - for symptomatic intracranial hemorrhage, 2.4% vs. 0.2%;  $P=0.008$ ).
  - Mortality did not differ significantly between the alteplase and placebo groups (7.7% and 8.4%, respectively;  $P=0.68$ ).

# TPA 3-4.5 hours

- Eligibility criteria same as 0-3 hour window plus the following additional exclusions:
  - patients older than 80 years,
  - all of those taking oral anticoagulants *even* with an international normalized ratio [INR] of  $\leq 1.7$
  - those with a baseline National Institutes of Health Stroke Scale score  $> 25$
  - those with *both* a history of stroke and diabetes

# Number-needed-to-treat (NNT) analysis

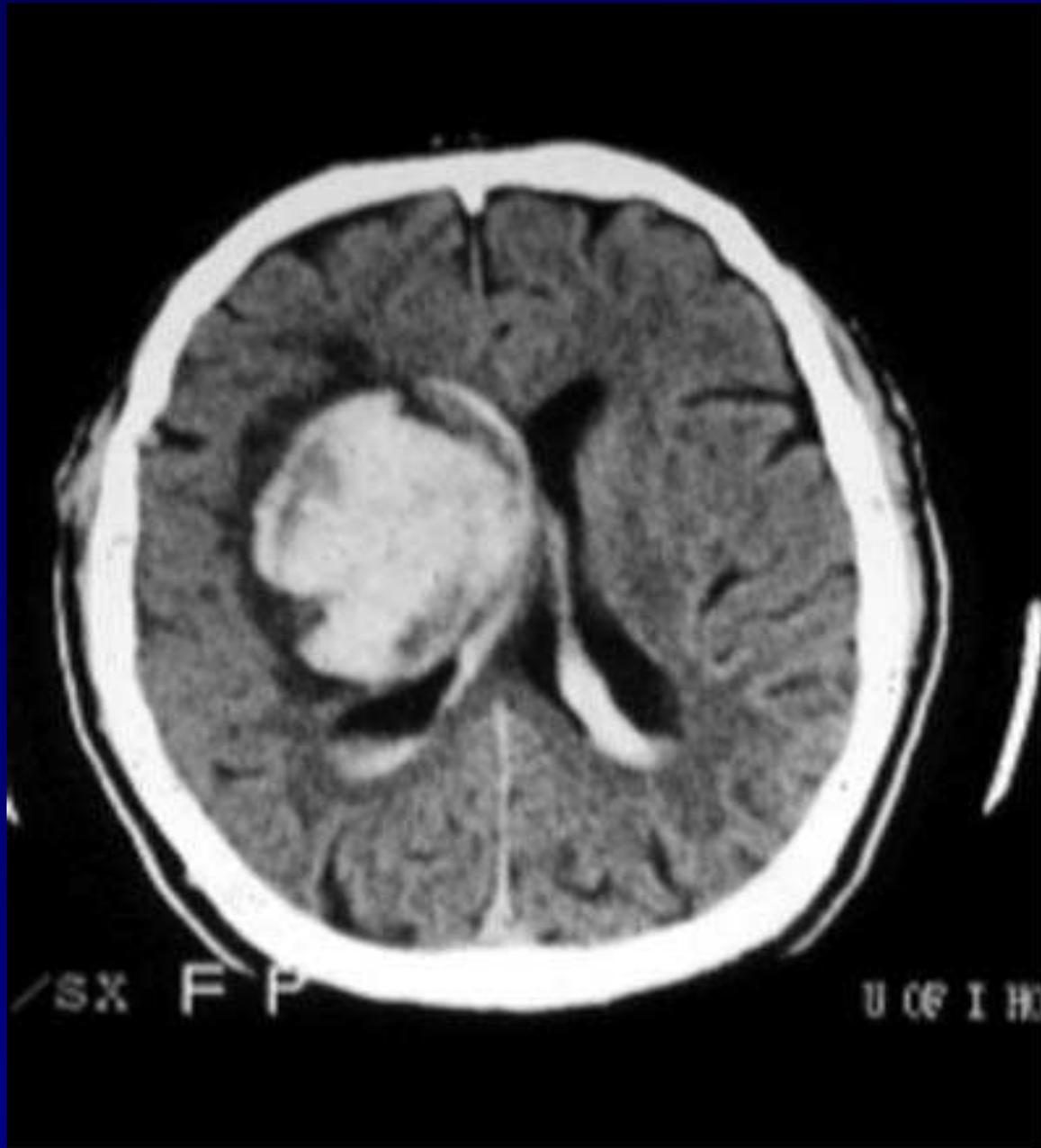
## Benefit versus Harm

- In how many patients do we have to use tPA in order to benefit (or harm) one patient?
  - Benefit defined as favorable outcome (0-1 on modified Rankin scale at 90 days criteria)
  - Harm defined as symptomatic ICH

	Per 100 Patients	
	1-3 hours (NINDS) <sup>1</sup>	3-4.5 hours (ECASS 3) <sup>2</sup>
<b>Benefit</b>	<b>13</b>	<b>7.2</b>
<b>(NNTB)</b>	<b>(8)</b>	<b>(14)</b>
<b>Harm</b>	<b>5.8</b>	<b>4.4</b>
<b>(NNTH)</b>	<b>(17)</b>	<b>(23)</b>
<b>Benefit/Harm Ratio</b>	<b>2.2</b>	<b>1.6</b>

1. NINDS rt-PA Stroke Study Group. *N Engl J Med.* 1995;333:1581-1587.

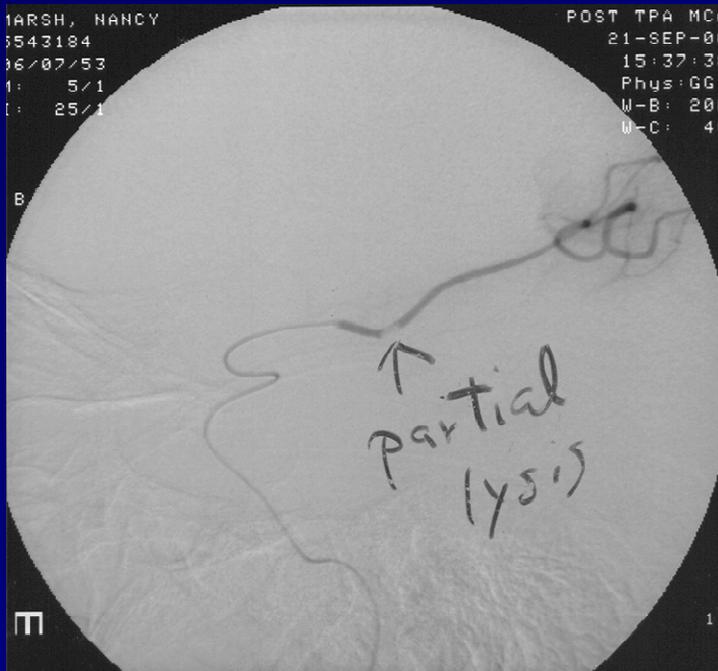
2. Hacke W, et al. *N Engl J Med.* 2008;359:1317-1329.



**Hemorrhagic transformation of an ischemic stroke**

# Thrombolysis: *Other Options*

- IV and IA (DRIP and SHIP)
- IV (2/3) - 0.6 mg/kg [15% bolus]
- IA (1/3) - 0.3 mg/kg [2 mg distal to “clot”;  
2 mg “intra-clot”  
9 mg/hr X 2 hrs; 22 mg max]
- IV GPIIb/IIIa receptor antagonists + IA thrombolysis
- Mechanical & pharmacologic thrombolysis
  - Snares, baskets, aspiration devices, balloons



# PROACT (I and II)

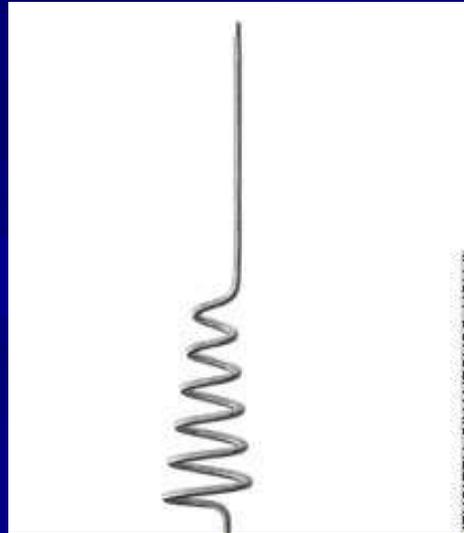
- Prourokinase
- Proximal MCA occlusions
- 6 hour window
- recanalization 66% vs. 18% controls
- mRS 0,1,or 2 significantly greater than control !
  - 58% more likely to have no clinical deficit
- Despite this FDA did not approve

Furlan A et al Jama 1999

# “PROs and CONs” of IA Thrombolysis

- Significant improvement for major strokes
  - (MCA and basilar territory)
- Window may be extended beyond 3 hours available for iv therapy
  - 6 (maybe 8) hours for MCA strokes; longer for basilar strokes
- Downside is need for a very specialized stroke team with neuro-interventional capabilities and time to assemble that team

# Merci Retriever Device



# Merci Trial

- 114 patients.
  - **Prospective non-randomized single-arm study**
    - Large vessel (ICA, MCA, VB, BA) strokes
  - **Historical control used for comparison**
    - Placebo arm of PROACT-II:
      - 27 percent mortality

# MERCI 1+2 Protocol Overview

## ■ Inclusion criteria:

- Time window 3-8 hours
  - Includes also 0-3 hours if patient not TPA candidate
- NIHSS>9
- Occlusion of ICA, M1, BA, VA
- CT: hypodensity <1/3 MCA territory

## ■ Primary Endpoints:

- Successful revascularization in all treatable vessels
- Major device related complications

## ■ Secondary Endpoints:

- Neuro. Status at 30 and 90 days (NIHSS and mRS)
- Major adverse events at 30 days (death, new stroke, MI)

# Merci Trial Results

- **47 percent event-free recanalization.**
  - Versus 18% in PROACT-II
- **38 percent mortality**
  - Versus 27% in PROACT-II placebo
    - Difference attributed to higher acuity in Merci Trial patients
  - Of 61 patients with recanalization: 25% death in 90 days
- **Complications:**
  - Device related adverse events 3.5%
  - 8 percent sx ICH
    - 2% in 'control' group
- *FDA approval for this device provided under a humanitarian IDE exemption!*

	Recanalization		Outcome (mRS ≤ 2)		Mortality		Symptomatic ICH		Baseline NIHSS	
	Rx	Cont	Rx	Cont	Rx	Cont	Rx	Cont	Rx	Cont
	PROACT-II N=180	66%	18%	40%	25%	25%	27%	10%	2%	17
IMS-I N=80	56%	.	43%	.	16%	.	6.3%	.	18	.
IMS-II N=73	58%	.	45%	.	16%	.	11%	.	19	.
MERCI N=141	60% 48%	.	28%	.	44%	.	7.8%	.	20	.
Multi MERCI N=164	68% 55%	.	36%	.	34%	.	9.8% 2.4%	.	19	.

Trial	Trial Design
<b>PROACT-II</b> JAMA 282 (1999) 2003-2011	Randomized, IA pro-UK vs. IV heparin
<b>IMS-I, II</b> Stroke 35 (2004) 904-911 Stroke 37 (2006) 708	Registry, IV t-PA + IA t-PA
<b>MERCI</b> Stroke 36 (2005) 1432-1438	Registry, IA thrombectomy, IA lytics allowed, IV disallowed
<b>Multi MERCI</b> AJNR 27 (2006) 1177-1182	Registry, IA thrombectomy, IA & IV lytics allowed

# PENUMBRA Aspiration Device

- An aspiration catheter, with a distal wire to keep the catheter clear, and a grasping device designed to remove harder thrombus if the aspiration device fails to recanalize the vessel.
- Approved under the 510K regulations in January 2008 as "substantially equivalent" to another currently approved mechanical device, the Concentric Balloon Guide Catheter (Concentric Medical Inc) for the indication of revascularization of patients with acute ischemic stroke secondary to large vessel occlusive disease within 8 hours of symptom onset.



# Penumbra Study: ISC Feb. 2008

## ■ Phase II study

- 125 patients at 24 international centers
- Single arm trial
  - NIHSS >7
  - Sx onset <8 hours
  - TIMI 0 or 1
  - Not eligible or no response to iv TPA
- 1° endpoints: revascularization (TIMI 2 or 3) and procedural SAEs.

## ■ Company designed and sponsored!

# PENUMBRA

- **Revascularization (TIMI 2 or 3): 82 percent of patients with aspiration device only versus the 48.2% historical control ( $p < 0.0001$ ),**
  - Adjunctive grasping device not approved as too few patients tested
- **3.2% procedural serious adverse events (SAE) rate versus the 7.1% historical control. There were 4 SAEs:**
  - Patient 1: balloon angioplasty with perforation of vessel and ICH/SAH,
  - Patient 2: SAH due to wire
  - Patient 3: ICH immediately following recanalization

# PENUMBRA

## ■ Favorable outcome

- at 30 days: 4 point improvement NIHSS at discharge or 30 day mRS <3 in 41.6% patients
- At 90 days: 25% of patients had mRS <3.

## ■ At 24 hours, ICH 35/125 (28%) with 14/125 (11.2%) with NIHSS deterioration >3 points

## ■ Mortality: 26.4% at 30 days and 32.8% at 90 days



**1. Early changes with loss of sulci and edema on the right side**

# Surgery for Acute Ischemic Stroke

- Emergent carotid endarterectomy and thrombectomy
  - limited utility
    - typically following acute post-CEA occlusions
    - intra-arterial snares, jets, lasers are being explored.
- Hemicraniectomy
  - To prevent herniation of the brain following massive stroke
    - a 'salvage' procedure
    - randomized trial underway

# Heparin in Acute Cerebral Ischemia

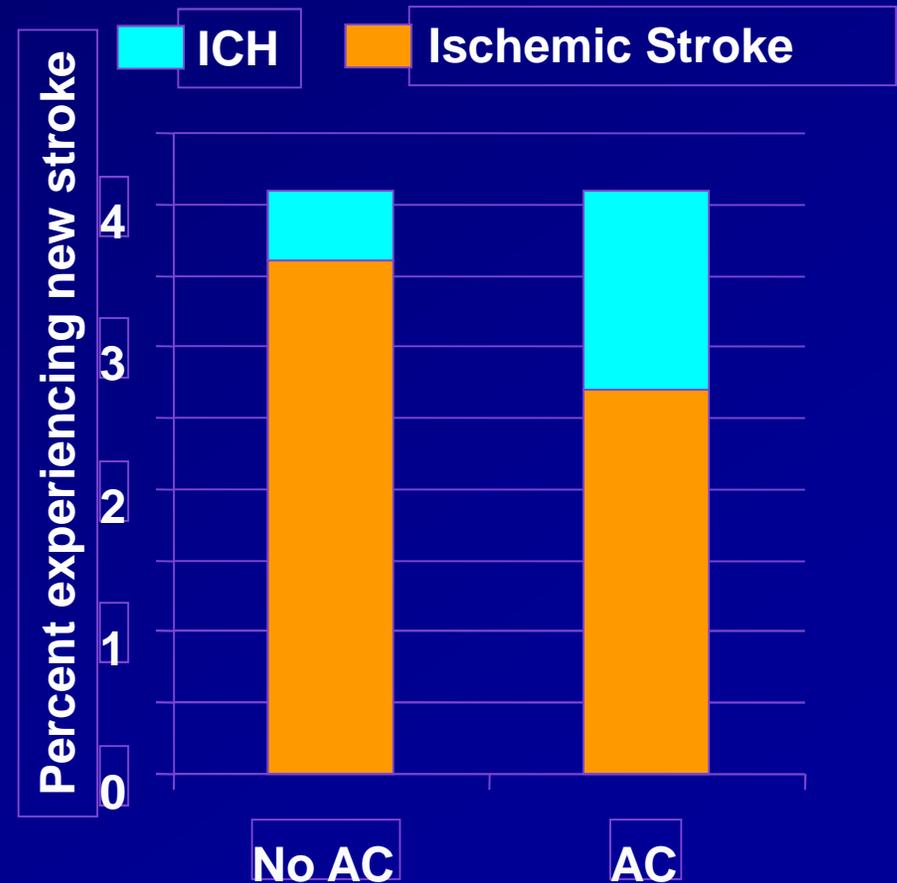
- ◆ **DVT prophylaxis**
- ◆ **Progressing, stuttering, unstable ischemia**
- ◆ **High degree carotid stenosis**
- ◆ **Cardioembolic stroke (? timing)**
- ◆ **Prosthetic valves**
- ◆ **Vertebro-basilar ischemia**
- ◆ **Acute partial stroke\*\***

# Anticoagulation for Acute Ischemic Stroke

- Urgent *routine* anticoagulation with goal of improving neurologic outcome or preventing early recurrence not recommended.
- Possible indications regarding immediate anticoagulation in specific patient groups unknown
  - Large-vessel atherothrombosis
    - from post hoc data of the TOAST trial maybe benefit in acute carotid artery territory stroke 2° to occlusion High risk of recurrent embolism
- Not recommended for moderate or severe stroke.
  - High risk of intracranial bleeding
- Contraindicated within 24 hours of tPA..
- NO BOLUS
  - goal is PTT 1.5-2.0 times control

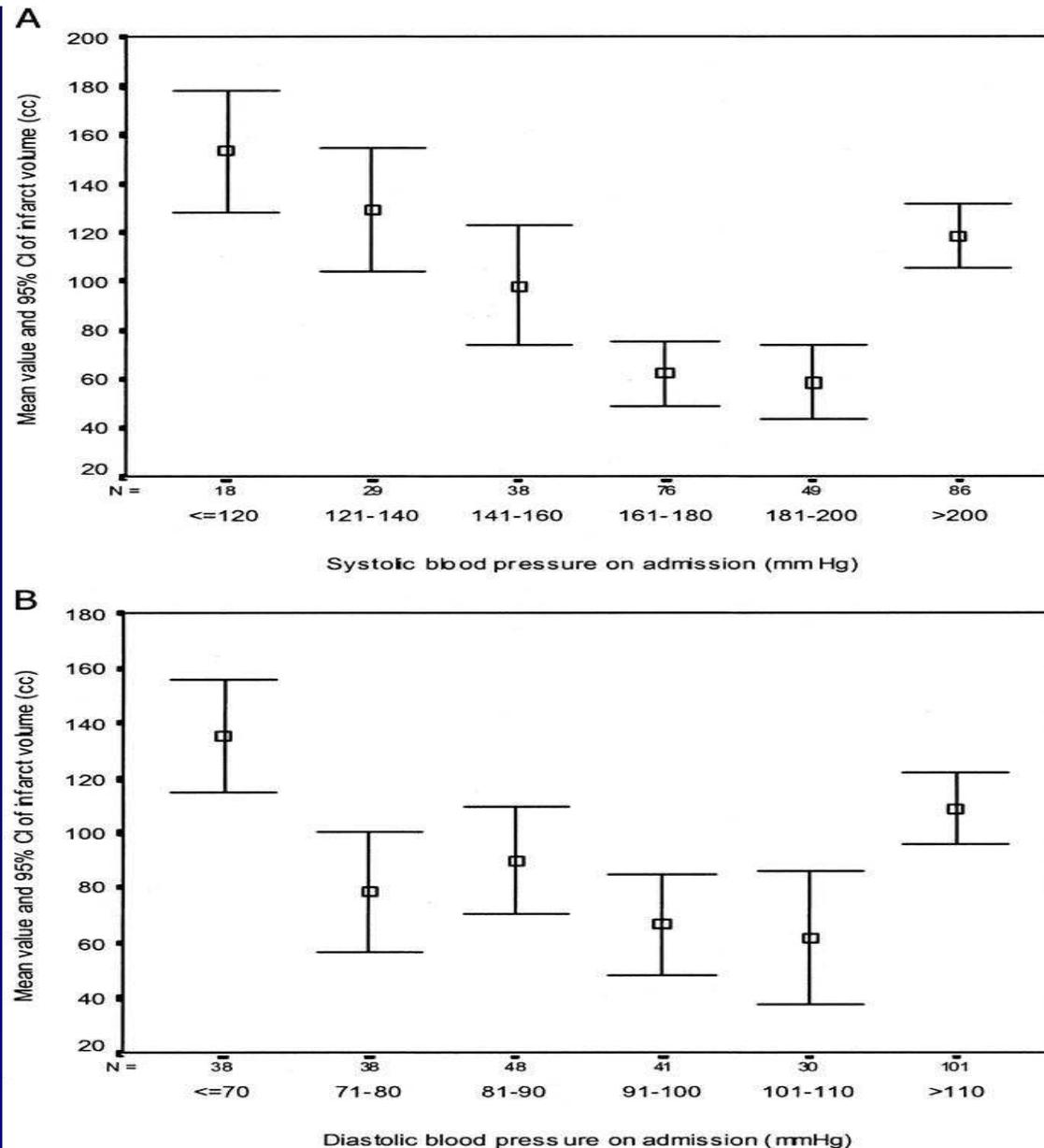
# Results of Anticoagulation: Meta-analysis

- No significant difference in 2-week mortality (8.5% in AC group vs 8.7% in controls)
- Total new strokes identical between 2 treatment groups: 4.1%
- No evidence of heterogeneity among various studies or agents



# Blood Pressure in Ischemic Stroke

- Acute elevations of BP are common in stroke.
  - Seen in 85% of patients
  - Often declines spontaneously in first 24-48 hours
- Cerebral autoregulation is defective in most stroke patients.
- Acutely lowering BP can expand area of ischemia.
  - Supported by PET studies
  - Supported by clinical experience
  - Supported by ASA guidelines



Mean value and 95% CIs of infarct volume on days 4 to 7 by SBP (A) and DBP (B) levels on admission. Castillo: Stroke, Volume 35(2).February 2004.520-526

# BP RX in Patients Eligible for Thrombolysis

- Before tPA treatment
  - Systolic >185 mm Hg or diastolic >110 mm Hg
    - Labetalol *or*
    - Nicardipine
  - If blood pressure does not decline and remains >185/110 mm Hg, do not administer tPA
- During and after tPA treatment: monitor blood pressure to keep under 180/120

# BP RX in Patients Not Eligible for Thrombolysis

## ⑩ Systolic <220 or diastolic < 120 mm Hg

⑩ Observe and do not treat unless evidence of end organ failure

⑩ MI, acute renal failure, hypertensive encephalopathy

## ⑩ Systolic >220 or diastolic >120 mm Hg

⑩ Labetalol 10-20 mg IV over 1-2 min (may repeat or double every 10 min, max 300 mg) or Nicardipine

⑩ Aim for 10%-15% reduction in blood pressure

## ⑩ Diastolic >140 mm HG

⑩ Nitroprusside (or nicardipine/labetalol)

⑩ Aim for 10%-15% reduction in blood pressure

MARSH, NANCY  
3543184  
06/07/53  
1: 5/1  
0: 15/1

LICA HEAD  
21-SEP-00  
14:28:32  
Phys:GG  
W-B: 200  
W-C: 57

Absent vessel  
↓

A

E

3

RUSH-PRESBYTERIAN-ST. LUKE'S MEDICAL CENTER

MARSH, NANCY  
3543184  
06/07/53  
1: 5/1  
0: 15/1

LICA HEAD  
21-SEP-00  
15:48:30  
Phys:GG  
W-B: 200  
W-C: 75

open vessel  
↓

A

E

14

RUSH-PRESBYTERIAN-ST. LUKE'S MEDICAL CENTER

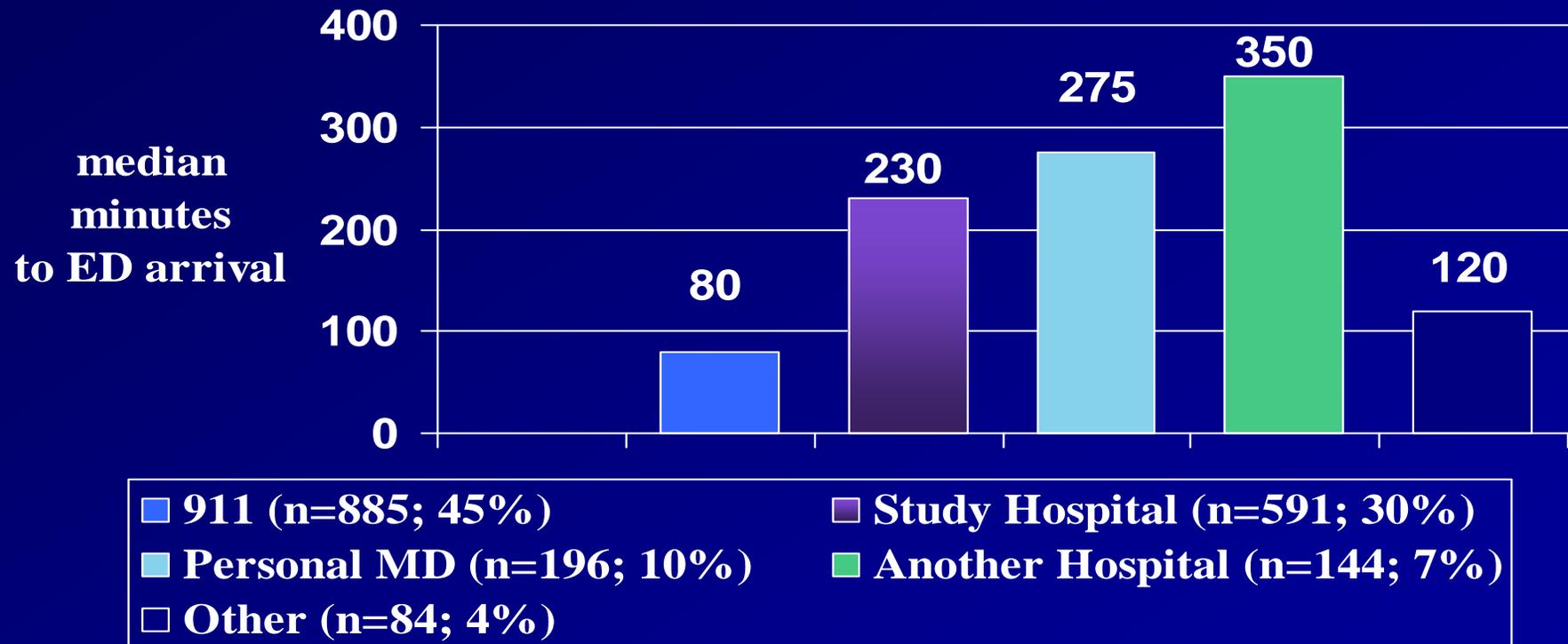
# Stroke Systems of Care

# “Efficacy versus Effectiveness”

Study is not the main thing but action.

Pirkei Avot  
Chapter 1

# Median ED Arrival Times Based on Type of First Medical Contact



**NINDS rt-PA Pilot Study.** Barsan WG et al Stroke 1994

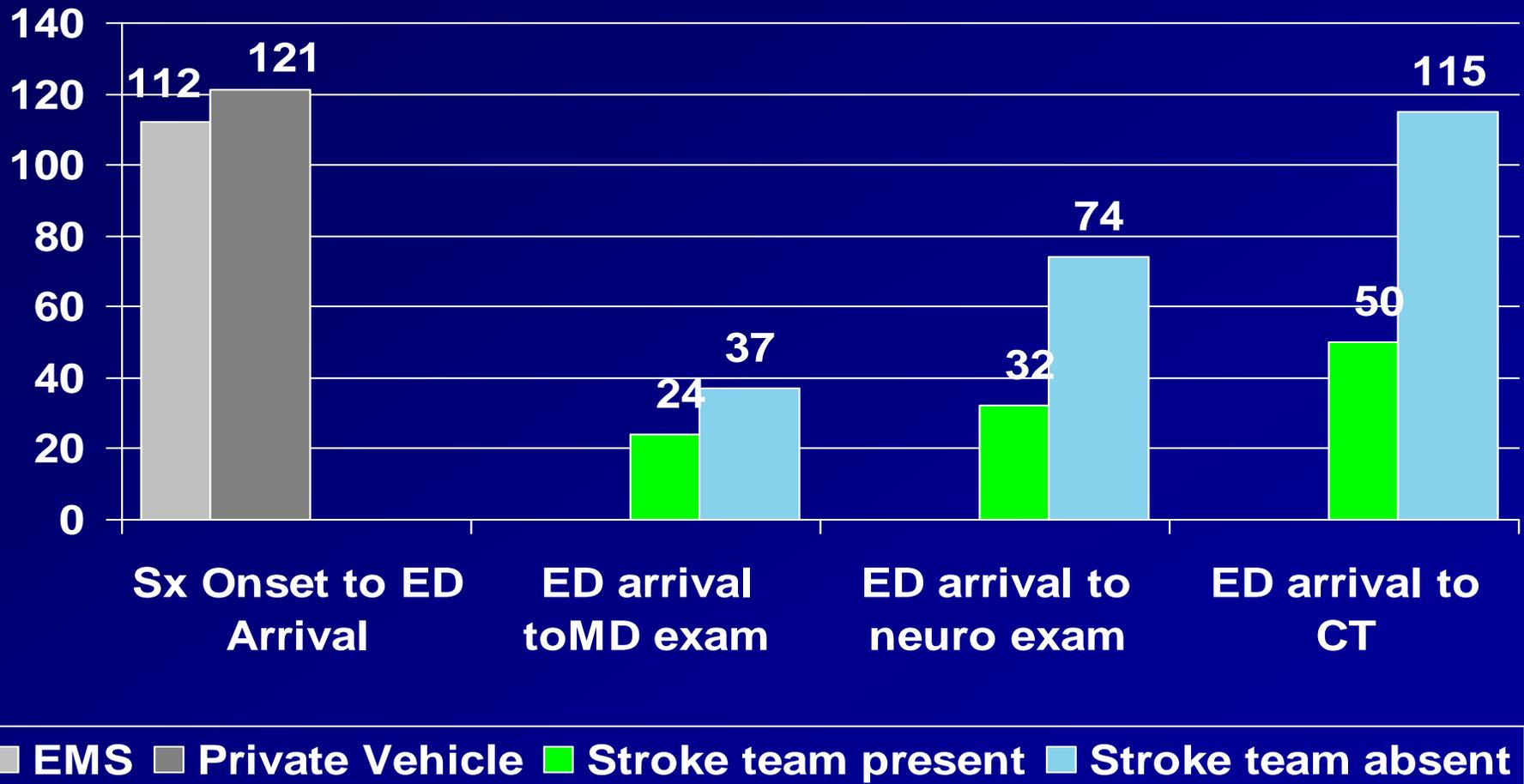
# Impact of rt-PA Protocols

## A Survey of North Carolina Hospitals

ITEM	% with rt-PA vs. without	P value
Community Awareness Programs	41 vs 17	0.003
Stroke Teams	31 vs 8	0.001
Stroke care maps/algorithms	56 vs 17	<0.001
Rapid stroke i.d. programs	33 vs 6	<0.001
Stroke Units	33 vs 7	<0.001
Neurologists	78 vs 33	<0.001

54 of 125 hospitals in 46 of 100 counties with 74% of state pop.  
had rt-PA protocols      Goldstein LB et al Stroke 1998

# Benefits of a Stroke Team in Acute Treatment



Bratina P et al Stroke 1995

# Outcomes for Stroke Units

	<u>Odds Ratio</u>
■ Decreased mortality:	0.83
■ Death or institutional care:	0.76
■ Death or dependency	0.75
■ Decrease in Length of Stay	2-11 days

Cochrane Database 1999

# Outcomes for Stroke Units

## Death or Institutional Care

	<u>Odds Ratio</u>
■ Men	0.66
■ Women	0.77
■ <75 yrs	0.77
■ >75 yrs	0.71
■ Mild stroke	0.84
■ Moderate stroke	0.73
■ Severe stroke	0.58

Cochrane Database 1999

# Stroke Centers:

## The three Levels of Care

### ■ Emergent stroke-ready hospitals

- Mainly for rural areas
- Stabilize stroke patients
- Use tPA then transfer out:
  - “drip and ship”

### ■ Primary stroke centers

- Provide initial, acute care
- Provide TPA and other acute therapies in a safe and efficient manner
- Admit patients to stroke unit

### ■ Comprehensive stroke centers

- Care for complex patients (large IS, ICH, SAH)
- Interventional and other specialized treatments (coils, stents, etc)
- Team approach with stroke specialists, neurointensivists, endovascular specialists and neurosurgeons

# Emergent Stroke-Ready Hospital (ESRH) and Primary Stroke Centers:

- Stroke team
- Rapid head CT
- Rapid laboratory testing
- Ability to give tPA and other acute therapies
- Various disease performance measures
- Stroke protocols
- ED/EMS support
- Staff education
- Administrative support

## **Primary stroke center also provides:**

- Stroke unit
- Neurosurgery within 2 hours

## **ESRH also provides:**

- Referral/transfer agreements with 1 or more primary stroke centers

Alberts MJ, et al. *JAMA*. 2000;283(23):3102-3109.

National Institute of Neurological Disorders and Stroke.

[http://www.ninds.nih.gov/news\\_and\\_events/proceedings/stroke\\_2002/acute\\_stroke\\_choosing.htm](http://www.ninds.nih.gov/news_and_events/proceedings/stroke_2002/acute_stroke_choosing.htm). Accessed January 21, 2010.

# Primary Stroke Centers

- Stroke teams
- Stroke unit<sup>s</sup>
- Written caremaps and protocols
- Emergency medical services
- Emergency department
- Availability of neurosurgical services
- Support of hospital administration
- Neuroimaging (CT/MR/etc)
- Laboratory services
- Outcome/quality assurance and improvement processes
- Continuing medical education

# Current Status of Stroke Center Certification: Primary Stroke Centers (PSCs)

- About 600 PSCs certified by The Joint Commission (TJC)
- About 250 PSCs certified by state-based organizations (NY, MA, FL)
- Many hospitals now going through recertification process
- New points of emphasis by TJC
  - Dysphagia screening and documentation
  - tPA administration to eligible patients
  - Nursing knowledge of the patient care plan and protocols
- Federal government (CMS, NQF) will begin looking at postdischarge outcomes for all patients

# BAC Update to PSC Recommendations

- Stroke unit with telemetry
- Stroke team response (in 15 minutes)
- MRI with diffusion for hospitalized patients and CTA or MRA
- Cardiac imaging
- Document why eligible patients were not given tPA
- Early rehabilitation
- National external certification

# Joint Commission Standardized Performance Measures for Primary Stroke Centers

- Venous thromboembolism prophylaxis
- Discharged on antithrombotic therapy
- Anticoagulation therapy for atrial fibrillation/flutter
- Thrombolytic therapy
- Antithrombotic therapy by end of hospital day 2
- Discharged on statin medication
- **Dysphagia screening\***
- Stroke education
- **Smoking cessation/advice/counseling\***
- Assessed for rehabilitation

**\* Will be retired in 2010.**

The Joint Commission Web site. [http://www.jointcommission.org/AboutUs/Fact\\_Sheets/psc\\_certification.htm](http://www.jointcommission.org/AboutUs/Fact_Sheets/psc_certification.htm).  
<http://manual.jointcommission.org/bin/view/Manual/Questions/UserQuestionId03Stk100036>.

# Telemedicine and Stroke

- Video links are reasonable for performing an exam with inter-rater reliability comparable to face to face exam
  - NIHSS can be done remotely by experienced stroke specialists
- Teleradiology is also a useful adjunct in acute stroke.
- It is recommended that stroke specialists using telemedicine provide opinion for/against TPA when on-site expertise not immediately available



# Early Management of Acute Stroke

## Summary Review

- Evaluate candidacy for thrombolytics
- CT: need to exclude ICH
- Early use of antiplatelet agents if not TPA candidate
- Early diagnostic studies
- ? Need for anticoagulation
- Consider NPO status and need for swallowing evaluation

# Early Management of Acute Stroke

## Summary Review

- Monitored bed (large strokes may need ICU bed for management of ICP)
- 0.9% NS only!
- Avoid (and treat) hypotension
- Avoid aggressive treatment of hypertension unless high risk.
  - If necessary, use an easily titratable agent such as i.v. labetalol, hydralazine, or nitroprusside
  - Except in thrombolysis cases, there is no absolute upper limit to the blood pressure
    - AHA guidelines suggest no rx unless SBP >220

# Early Management of Acute Stroke

## Summary Review

- Early PT/OT, Speech therapy, Rehab
- Aspiration precautions/consider NPO/swallow
- DVT prophylaxis
- Skin care
- Euglycemia
- Normothermia

# Conclusions

- >80 percent of all stroke is ischemic (atherothrombotic or embolic) in etiology
- Acute recanalization is imperative
  - Intravenous TPA is the preferred treatment strategy
    - Must be given within 3 hours of symptom onset with strict criteria applied for patient eligibility
    - Can be given up to 4.5 hours in selected patients
  - Intra-arterial thrombolysis (pharmacologic and/or mechanical) is an option for patients with large strokes or who are outside the iv TPA window
- Despite above, stabilization for ALL stroke patients is indicated
  - Avoid medical complications
  - Don't overtreat BP
  - DX and RX must be expedited

The day is short, the work is great,  
the workers are lazy, the reward is  
great, and the Master of the house  
presses.

Pirkei Avot Chapter 2

# The End

