RECENT CONTROVERSIES IN ACUTE STROKE

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INTRODUCTION AND OVERVIEW
- Prehospital Care of Stroke
- Routing to Certified Primary Stroke Centers
- Treatment in the Field
- Emergency Department Care of Stroke
- Thrombolysis in the 3 to 4.5 hour window
- Acute Blood Pressure Management
- Endovascular and Interventional Treatment of Stroke
- How to select patients for Transfer and Intervention
- The Stroke Unit and Care of the Hospitalized Stroke Patient
- When to start stroke prevention interventions
- Conclusions

HOW MANY STROKES OCCUR IN ONE YEAR IN THE UNITED STATES
- A. 8,000
- B. 80,000
- C. 800,000
- D. 8,000,000

STROKE AND TIA IN THE UNITED STATES
- Prevalence
  - 2.6% of US population or 6 million cases
- Incidence
  - 800,000 new or recurrent strokes each year
  - 1 stroke every 40 seconds
  - 5,000,000 TIA patients each year estimated
- Morbidity/mortality
  - 1 of every 15 deaths
  - Fourth leading cause of death
  - The leading cause of long-term disability
  - 2010 direct and indirect cost of stroke: $60 billion

Ideal Model of Acute Ischemic Stroke Care

CERTIFIED PRIMARY STROKE CENTERS IN THE UNITED STATES
- Joint Commission
  - 708
- HFAP (Osteopathic)
  - 15
- Dept of Health/EMS
  - 290
- Total ~950
WHY GO TO A PRIMARY STROKE CENTER?

- More expertise, more often treated
- Faster evaluation
- Less complications

**JAMA. 2011;305(4):373-380**

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IMPACT OF ESTABLISHING A PRIMARY STROKE CENTER

**Percentage of Patients Treated With tPA Related to the Establishment of a Primary Stroke Center**

![Graph showing percentage of patients treated with tPA](image)

**Lattimore SU et al. Stroke. 2003;34:e55-e57.**

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PRIMARY STROKE CENTER COVERAGE OF US POPULATION IN 2010

18 states, multiple additional counties

**States**
- Connecticut
- Delaware
- Florida
- Georgia
- Illinois
- Maryland
- Massachusetts
- Missouri
- New Jersey
- New Mexico
- New York
- North Dakota
- Oklahoma
- Rhode Island
- Texas
- Utah
- Virginia
- Washington

**Counties**
- Alabama
- Arizona
- Maine
- Montana
- Nebraska
- Nevada
- New Mexico
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- Oregon
- Pennsylvania
- Rhode Island
- South Carolina
- South Dakota
- Tennessee
- Texas
- Utah
- Virginia
- Washington

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CALIFORNIA STROKE SYSTEMS - STATUS

- California
  - 93 JC Certified Primary Stroke Centers
  - 16 of 58 County EMS Stroke Systems
  - Primary Stroke Center systems
    - Alameda
    - Butte
    - Colusa
    - Kern
    - Los Angeles (partial)
    - Nevada
    - Placer
    - Sacramento
    - San Diego
    - San Francisco
    - Santa Clara
    - Sutter
    - Yolo
  - Two Tier Primary and Comprehensive Stroke Center systems
    - San Francisco
    - Orange - 9 (6) of 26 hospitals

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LOS ANGELES COUNTY STROKE REGIONAL SYSTEM OF CARE

**LASTROKE.COM**

- Paramedics have the option to bring acute stroke patients directly to JC-certified PSCs
- LAPSS positive, under 2 hour patients
- Travel time must be no more than 30 minutes (generally much less)
- Patient requests for a local, non-PSC will be honored

- Cedars Sinai
- Glendale Adventist
- Henry Mayo Newhall
- Huntington
- Kaiser Los Angeles Medical Center
- Long Beach Memorial
- Los Alamitos
- Los Robles
- Methodist
- Northridge
- Pomona Valley Medical Center
- Presbyterian Intercommunity Hospital
- Providence - St. Joseph
- Providence Tarzana
- Saint Jude
- Torrance Memorial
- UCLA Medical Center
- White Memorial

Anticipate eventually 25-50
DOES STROKE CENTER DIVERSION WORK?
- Prospective data is lacking
- What are the metrics?
- Are delays built into the system?
- LA EMS will be collecting data
  - How can we get this information now

Role of neuroprotection

Neuroprotection could help limit the damage caused by stroke

Without neuroprotection
Permanent ischemic damage

With neuroprotection
Ischemic damage minimized


The Ideal Neuroprotectant

- Safe in ischemic stroke
- Safe in hemorrhagic stroke
- Inexpensive
- Easily administered
- Easily stored
- Can be started quickly

Possible Effects of Magnesium

Vascular
- Increased Cardiac Output
- Increased Regional CBF

Neuronal
- NMDA Ion Channel Blockade
- Ca²⁺ Channel Blockade
- Enhanced ATP Recovery

Primary Stroke Centers (11/2009)
Primary Stroke Centers (09/2011)

The NIH Field Administration of Stroke Therapy - Magnesium Phase 3 Clinical Trial

The Effect of Diversion on Stroke Cases Going to PSC vs. Non-PSC

• Before (N=215)
  • 17% taken to PSC
  • Transport time 32 minutes

• After (N=225)
  • 88% taken to PSC
  • Transport time 33 minutes

Sanossian et al. Stroke, 42(3):e146, 2011

Important Metrics at PSCs in Los Angeles County (N=1000)

• After PSC Triage
  • Door to TPA treatment
  • Door to Imaging: 32 min

• Before PSC Triage
  • Door to TPA treatment
  • Door to Imaging: 45 min

Unpublished Data: Submitted to 2012 ISC Meeting

IMPACT OF PSC ACUTE ISCHEMIC STROKE TREATMENTS

<table>
<thead>
<tr>
<th>Treatment</th>
<th>NNT</th>
<th>Benefit per 100 pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA 1-3h</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>TPA 3-4.5h</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Stroke Unit</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Aspirin</td>
<td>77</td>
<td>1</td>
</tr>
</tbody>
</table>

PREHOSPITAL TREATMENT

• The future of stroke care?
• How early can treatment be initiated?
• Can one diagnose stroke in the field accurately?
• How soon can you get a treatment started?

Enrollment as of 9/12/2011

N= 1367

20%

30%

50%
Key Time Intervals

- Stroke onset to study drug (median): 46 mins
- Paramedic arrival on scene to drug (mean): 27 mins
- Paramedic arrival on scene to ED (mean): 33 mins
- Treated within 1 hour of onset: 73%

EMERGENCY DEPARTMENT TREATMENT OF STROKE

- Making an accurate diagnosis of stroke subtype
- Ischemic Stroke
  - Considering thrombolysis
  - Considering endovascular interventions
- Intracerebral Hemorrhage
  - Lowering Blood Pressure Early and Aggressively

IN A TYPICAL ACUTE ISCHEMIC STROKE

- Every minute the brain loses how many neurons?
  - A. 20,000
  - B. 200,000
  - C. 2,000,000
  - D. 20,000,000

TIME TO TREATMENT AND BENEFIT OF IV-TPA POOLED ANALYSIS OF 6 IV TPA TRIALS

- mRS 0-1 at day 90
- Adjusted odds ratio with 95% confidence interval by stroke onset to treatment time (OTT)

IV TPA UNDER 3 HOURS – CHANGES IN OUTCOME DUE TO TREATMENT

- Outcome
  - NNTB
  - Nml/Near Normal: 8.3
  - Improved: 3.1

For every 100 patients treated with tPA, 32 benefit, 3 harmed

--Saver, Arch Neurol 2004; 61:1066-1070; Stroke 2007; 38:2279-2283
--AAN/ACEP/AHA Patient Educational Tool 2008

UCLA Stroke Center
TPA OUTSIDE OF 3 HOURS
- FDA approved for treatment of acute ischemic stroke up to 3 hours
- ECASS 3 Study was performed in Europe in a distinct population
- New AHA recommendations
  - To treat
  - Consensus?

THROMBOLYSIS WITH ALTEPLASE 3 TO 4.5 HOURS AFTER ACUTE ISCHEMIC STROKE
- Werner Hacke et al for the ECASS Investigators NEJM 359:1317-1329
- 821 patients randomized
  - 418 to the alteplase group
  - 403 to the placebo group
- The median time was 3 hours 59 minutes
- Favorable outcome with alteplase
  - (52.4% vs. 45.2%; odds ratio, 1.34; P=0.04)
- Intracranial hemorrhage more with alteplase than with placebo
  - Any ICH, 27.0% vs. 17.6%; P=0.001
  - Symptomatic ICH, 2.4% vs. 0.2%; P=0.008
- Similar mortality & other SAE
  - (7.7% and 8.4%, respectively; P=0.68)

AHA GUIDELINES (2009)
- “rtPA 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)”
  - Patients older than 80 years
  - Those taking oral anticoagulants
  - Baseline NIHSS score 25
  - Both a history of stroke and diabetes
  - Established infarct signs on CT/MR in >1/3 MCA
- "Although a longer time window for treatment with rtPA has been tested formally, delays in evaluation and initiation of therapy should be avoided, because the opportunity for improvement is greater with earlier treatment."
- Application to FDA for labeling change to be submitted early next year

NUMBER NEEDED TO TREAT TO BENEFIT FROM IV TPA ACROSS FULL RANGE OF FUNCTIONAL OUTCOMES

<table>
<thead>
<tr>
<th>Outcome</th>
<th>≤3hrNNT</th>
<th>3-4.5hrNNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal/Near Normal</td>
<td>8.3</td>
<td>14</td>
</tr>
<tr>
<td>Improved</td>
<td>3.1</td>
<td>5.9</td>
</tr>
</tbody>
</table>

- For every 100 patients treated 3-4.5 hours 17 benefit and 3 are harmed


BP IN ISCHEMIC STROKE
- Elevated BP >160 mm Hg are detected in >60% of patients with acute stroke
- Both elevated and low BP are associated with poor outcome
- Every 10-mm Hg increase over 180
  - Neurological deterioration increased by 40%
  - Poor outcome increased by 23%

WHY ELEVATED BP IN ACUTE STROKE?
- Stress of the cerebrovascular event
- Full bladder
- Nausea
- Pain
- Preexisting hypertension
- Physiological response to hypoxia
- Response to increased intracranial pressure
**ELEVATED BP: TO TREAT OR NOT TO TREAT**

**To Treat:**
- Reducing the formation of brain edema
- Lessen the risk of hemorrhagic transformation
- Prevent further vascular damage
- Prevent early recurrent stroke
- Treat other manifestations of HTN
  - HTN encephalopathy, aortic dissection, ARF, pulmonary edema, or acute MI

**Not to Treat:**
- Cerebral blood flow is maintained from 50 to 150 mm Hg
- In cerebral ischemia there is loss of autoregulation, so CBF is dependent on perfusion pressure
- High BP often not treated for fear of exacerbating ischemia

**COLLATERAL CIRCULATION IN ACUTE STROKE**

**INTRACEREBRAL HEMORRHAGE**

**HEMATOMA GROWTH**
### INTERACT1: Reduction in absolute hematoma growth over 72 hours according to time from onset to treatment (Unpublished data)

<table>
<thead>
<tr>
<th>Time from onset to treatment</th>
<th>Absolute growth Favors intensive guideline</th>
<th>Reduction in Volume Favors intensive guideline</th>
<th>P for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2.9h</td>
<td>-4.4 ml</td>
<td>Favors intensive guideline</td>
<td>6.5 ml 0.1</td>
</tr>
<tr>
<td>2.9-3.6h</td>
<td>0.1 ml</td>
<td>Favors intensive guideline</td>
<td>3.3 ml 0.0</td>
</tr>
<tr>
<td>3.7-4.8h</td>
<td>-1.1 ml</td>
<td></td>
<td>0.9 ml 0.1</td>
</tr>
<tr>
<td>≥4.9h</td>
<td>-0.2 ml</td>
<td></td>
<td>0.6 ml 0.3</td>
</tr>
</tbody>
</table>

Reduction in hematoma growth over 72h (ml)

-5 0 5 10 15

**Reduction in Volume**

-5 0 5 10 15

### AHA BLOOD PRESSURE GUIDELINES

**Ischemic Stroke**
- Patients who have other medical indications for aggressive treatment of blood pressure should be treated.
- Patients with markedly elevated blood pressure (220/120) may have their blood pressure lowered.
- A reasonable goal would be to lower blood pressure by 10% during the first 24 hours after onset of stroke.

**Intracerebral Hemorrhage**
- No evidence exists to support a specific BP threshold.
- Treat SBP >180 mm Hg and/or mean arterial pressure >130 mm Hg.
- When SBP is 150-220 it is safe to target 140.

*Circulation* 2007;115:478-534

*Stroke* 2010; 41: 2108-2129

### INTRA-ARTERIAL RECANALIZATION THERAPIES

**Advantages**
- High concentration of lytic agent at clot site
- Gentle mechanical disruption of clot
- Option of pure mechanical strategy
- High early recanalization rates, 60-80%
- Precise knowledge of occlusion, recanalization

**Disadvantages**
- Delayed start of therapy
- Procedural risks - vessel rupture, dissection, etc
- Available only at specialized centers

*UCLA Stroke Center*

### META-ANALYSIS IA FIBRINOLYSIS

**A** (Gross outcome (modified Rankin Scale 0-5))

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Intervention</th>
<th>Control</th>
<th>Total</th>
<th>Favor</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fieschi 2006</td>
<td>60.12</td>
<td>32</td>
<td>92</td>
<td>8.9</td>
<td>2.7 (0.9, 7.8)</td>
</tr>
<tr>
<td>MILES 2005</td>
<td>127</td>
<td>120</td>
<td>247</td>
<td>32</td>
<td>1.5 (0.9, 2.5)</td>
</tr>
<tr>
<td>ECASS 2004</td>
<td>89</td>
<td>88</td>
<td>177</td>
<td>10</td>
<td>1.0 (0.6, 1.6)</td>
</tr>
<tr>
<td>IRAS 2001</td>
<td>8</td>
<td>6</td>
<td>14</td>
<td>2</td>
<td>0.0 (0.0, 0.0)</td>
</tr>
</tbody>
</table>

Total 595 | Favor 191 |

**B** (Excellent outcome (modified Rankin Scale 0-2))

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Intervention</th>
<th>Control</th>
<th>Total</th>
<th>Favor</th>
<th>Odds Ratio (95% CI)</th>
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<td>8</td>
<td>6</td>
<td>14</td>
<td>2</td>
<td>0.0 (0.0, 0.0)</td>
</tr>
</tbody>
</table>

Total 595 | Favor 191 |
NUMBER NEEDED TO TREAT TO BENEFIT FROM IA PRO-UK ACROSS FULL RANGE OF FUNCTIONAL OUTCOMES

<table>
<thead>
<tr>
<th>Outcome</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal/Near Normal</td>
<td>11.1</td>
</tr>
<tr>
<td>Improved</td>
<td>4.8</td>
</tr>
</tbody>
</table>

For every 100 patients treated with IA Pro-UK, 21 benefit, 4 harmed

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MECHANICAL ENDOVASCULAR RECANALIZATION DEVICES

- **Endovascular Thrombectomy**
  - Clot Retrieval Devices
    - Merci Retriever
    - Phenox Retriever
    - Catch Device
    - Microsnares
  - Suction Thrombectomy
    -Penumbra system
    -Syringe suction
    -Angiojet/Neurojet

- **Mechanical Disruption**
  - Stenting
  - Angioplasty
  - Laser
  - EPAR Device
  - LaVSC Device
  - Augmented Fibrinolysis
  - Microwire passage
  - Endovascular ultrasound

APPROVED CEREBRAL ENDOVASCULAR RECANALIZATION DEVICES

<table>
<thead>
<tr>
<th>Device</th>
<th>US</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merci Retriever</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Penumbra System</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phenox Retriever</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Catch Device</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

30-YEAR-OLD FEMALE – BASELINE NIHSS 24 SYMPTOM ONSET TO FINAL ANGIOGRAM – 5:37

NIHSS 24 hours 1 mRS 5 days post 0
30 days post 0 90 day post 0

MULTICENTER TRIALS OF THE MERCI RETRIEVER DEVICES

- Mechanical Embolus Removal in Cerebral Ischemia (MERCI) Trial
  - 25 sites in US, 141 pts
  - X5, X6
  - Up to 8 hours after onset, VA, BA, ICA, M1 MCA, M2 MCA
  - IV TPA patients excluded
  - Rescue IA therapies allowed
  - Primary endpoint: recanalization

- Multi-MERCI Trial
  - 14 sites US/Canada, 111 pts
  - X5, X6, L5, L6
  - Up to 8 hours after onset, VA, BA, ICA, M1 MCA, M2 MCA
  - "Failed" IV TPA patients permitted
  - Rescue IA therapies allowed
  - Primary endpoint: recanalization
90-DAY MODIFIED RANKIN SCORE
REVASCULARIZED VS. UNREVASCULARIZED

<table>
<thead>
<tr>
<th></th>
<th>Recan</th>
<th>Non-Recan</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRS 0-2</td>
<td>55%</td>
<td>32%</td>
</tr>
<tr>
<td>mRS 3-5</td>
<td>16%</td>
<td>62%</td>
</tr>
<tr>
<td>Death</td>
<td>31%</td>
<td>0%</td>
</tr>
</tbody>
</table>

n= 51
n= 47

PENUMBRA SYSTEM: REGISTRATION TRIAL

- 125 patients
- NIHSS 17.6
- Recanalization (TIMI 2-3)
  - Reported "82%"
  - Likely lower using standard ratings
- SICH 11.2%
- Nondisabled (mRS 0-2) outcome 90 d 25%
- Death 90 d 33%

THE NEW WAVE IN ENDOVASCULAR RECANALIZATION DEVICES: RETRIEVEABLE STENTS

- Advantages
  - Immediate reperfusion
  - Potential clot retrieval
  - Potential longterm stenting
- Devices
  - Solitaire stent
  - eV3
  - Minframe stent
  - Minframe, Inc.
  - ReSolve stent
  - ReVascular Medical
  - Trevo stent
  - Concentric - TREVO Trial

MECHANICAL EMBOLECTOMY: CURRENT TRIALS

- MR RESCUE (NIH)
  - Multicenter, phase 2, 120 patients
  - IA mechanical embolectomy vs medical, < 8h
- MR CLEAN
  - Netherlands multicenter, phase 3, 500 patients
  - IA device or drug vs medical, < 6h
- IMS 3 (NIH)
  - Multicenter, phase 3, 900 patients
  - IV TPA vs IV TPA + IA device or drug, < 3h
- Thrace - France, Q1 2010
  - France multicenter, phase 3, 480 patients
  - IV TPA vs IV TPA + IA mechanical embolectomy, < 4.5h

PENUMBRAL IMAGING AND MECHANICAL EMBOLECTOMY

- 23 patients treated with Concentric Clot Retriever
- Mean age 62 (range 28-90)
- Median pretreatment NIHSS 19 (range 10-26)
- 14 patients (54%) demonstrated pretreatment penumbral MRI pattern*
- Partial or complete recanalization 70%

*(PWI - DWI diameter ≥ 20%)

PENUMBRAL PATTERN: RECANALIZATION, GOOD OUTCOME

- Baseline NIHSS 13 Left MCA Occlusion, TIMI 2
- Recanalization at 5½ Hrs. Day 30 mRS 0
**NON-PENUMBRAL PATTERN: RECANALIZATION, POOR OUTCOME**

Baseline NIHSS 19, Right MCA Occlusion, TIMI 2
Recanalization at 4 ½ Hrs, Day 30 mRS 4

**WHO SHOULD BE CONSIDERED FOR INTRA-ARTERIAL THERAPY**

- < 3 hrs: IV TPA, followed by IA if no response
  - Can wait an hour until end of infusion
- 3-8 hrs: IA
- 8-14 hrs: IA if favorable MR/CT pattern
- Selection of IA
  - Presumed thrombus without major in situ athero
    - Proximal
    - Merci Retriever and/or Penumbra
  - Distal
  - IA TPA
  - Presumed in situ athero with supervening thrombus
    - Primary angioplasty +/- stenting +/- lytic

**THE STROKE UNIT**

- When to start stroke prevention interventions
- Antithrombotic Agents
  - Which agents to choose
  - When to initiate
- Antihypertensive agents
  - How many and which agents
  - When to initiate
- Statins
  - Agent and dose
  - When to start

**SEVENTH JOINT NATIONAL COMMITTEE ON PREVENTION, DETECTION, EVALUATION, AND TREATMENT OF HIGH BLOOD PRESSURE**

<table>
<thead>
<tr>
<th>BP classification</th>
<th>SBP* mm Hg</th>
<th>DBP* mm Hg</th>
<th>Lifestyle modification</th>
<th>Without compelling indications</th>
<th>With compelling indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120 and +80</td>
<td>Encourage</td>
<td>No antihypertensive drug indicated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139 or 80-89</td>
<td>Yes</td>
<td>Thiazide-type diuretics for most. May consider ACEI, ARB, BB, CCB, or combination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>140-159 or 90-99</td>
<td>Yes</td>
<td>Drug(s) for the compelling indications¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>≥160 or ≥100</td>
<td>Yes</td>
<td>Two-drug combination for most (usually thiazide-type diuretic and ACEI or ARB or CCB) as needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Treatment determined by highest category.

¹ Treat patients with chronic kidney disease or diabetes to BP goal of less than 130/80 mm Hg.

Patients presenting with acute stroke who get aspirin in the acute phase benefit. What is the magnitude of benefit?

A. 9 per 1000
B. 90 per 1000
C. 900 per 1000
D. There is no benefit for aspirin

**ASPIRIN IN ACUTE STROKE**

**ANTITHROMBOTIC AGENTS AND THE AHA GUIDELINES**

- No role for routine anticoagulation
  - Urgent anticoagulation with the goal of preventing early recurrent stroke, halting neurological worsening, or improving outcomes after acute ischemic stroke is not recommended for treatment of patients with acute ischemic stroke (Class III, Level of Evidence A)
- Only aspirin has been studied in the acute phase
  - The oral administration of aspirin (initial dose is 325 mg) within 24 to 48 hours after stroke onset is recommended for treatment of most patients (Class I, Level of Evidence A)
- Loading of clopidogrel in acute stroke
  - Case series demonstrating safety but no controlled studies
  - The administration of clopidogrel alone or in combination with aspirin is not recommended for the treatment of acute ischemic stroke (Class III, Level of Evidence C)

**BENEFIT OF EARLY ASPIRIN TREATMENT IN ACUTE ISCHEMIC STROKE (<48 HOURS)**

Benefit Per 1000: 9

**ACUTE STATINS**

In acute coronary syndromes acute statin use decreased stroke

Evidence that statin should not be discontinued in acute stroke

Evidence that in-hospital initiation of statin is associated with high rates of compliance and goal

**SUMMARY**

- Prehospital triage of stroke is the first step
  - Get to the right hospital
  - Is there a role for prehospital therapy?
- Emergency Room Therapy
  - Should you treat with TPA after 3 hours?
  - Yes but only in a select few
  - Should you consider endovascular intervention?
  - Severe stroke in patients with good baseline functioning
  - What should you do about blood pressure?
    - In ICH bring it down very fast, in ischemic stroke slowly
- In the Stroke Unit
  - Start aspirin and statin within 24 hours, and BP meds after
- Time is brain, but the best stroke is the one that never was
  - Prevention is better than any intervention

**Table 2. Cholesterol Levels in 92 Patients With Ischemic Stroke and TIA Who Started Receiving Statins Before Hospital Discharge**

<table>
<thead>
<tr>
<th>Serum Lipid Parameter, mg/dL</th>
<th>Admission</th>
<th>3 mo After Discharge</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL-C</td>
<td>120.1 ± 40.7</td>
<td>78.9 ± 24.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>HDL-C</td>
<td>47.6 ± 12.4</td>
<td>46.8 ± 11.8</td>
<td>.50</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>195.6 ± 48.4</td>
<td>145.6 ± 35.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Non-HDL-C</td>
<td>145.0 ± 48.4</td>
<td>102.8 ± 30.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>151.2 ± 116.3</td>
<td>132.6 ± 100.1</td>
<td>.11</td>
</tr>
<tr>
<td>% With LDL-C &lt; 100 mg/dL</td>
<td>38% (31/87)</td>
<td>88% (79/90)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>