Acute Ischemic Stroke Intervention: Patient Selection for the new 24-hour Time Window

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Disclosure

- none

OMG, I have finally discovered what's wrong with my Brain:
on the left side, there is nothing right, and on the right side, there is nothing left.
Educational Objectives:

1. To learn about advanced imaging techniques for patient selection in acute stroke intervention

2. To present examples illustrating the application of imaging and clinical criteria in selecting patient who may benefit from intervention using extended time window
Ischemic stroke due to large vessel occlusion
Major Predictors of Acute Stroke Intervention Outcome

Recanalization rate

Size of Tissue at Risk (Penumbra)

Size of Infarct Core at time of treatment
MRI - +DWI  CT- Hypodense
CBF < 10 ml/100g/min
Cytotoxic edema
Irreversible

MRI - +PWI  CT- normal
CBF 10-18 ml/100g/min
Neuronal paralysis
Potentially reversible ischemia
Thrombectomy < 6 hours

<table>
<thead>
<tr>
<th>Study</th>
<th>Endovascular</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR CLEAN CT Scan</td>
<td>33%</td>
<td>19%</td>
</tr>
<tr>
<td>SWIFT PRIME CT/MR Perfusion*</td>
<td>63%</td>
<td>38%</td>
</tr>
<tr>
<td>EXTEND-IA CT Perfusion</td>
<td>71%</td>
<td>40%</td>
</tr>
</tbody>
</table>

*Core ≤ 50 ml
Acute Stroke Treatment Evolution

1995

Salvageable tissue

Risk Ratio

Therapeutic Benefit

Risk of Bleeding

3-Hour

4.5-Hour

6-Hour

Time

1995

2008

2015

Line of Futility

10
Thrombectomy 6-24 hrs

**Graph:**

- **Y-axis:** Good Outcome (%)
- **X-axis:** mRS 0-2 at 90 days
- **Legend:**
  - HERMES
    - Early Window
    - Endovascular: 46%
    - Control: 27%
  - DAWN + DEFUSE 3
    - Late Window
    - Endovascular: 47%
    - Control: 15%
Acute Stroke Treatment Evolution

Salvageable tissue

1995 2008 2015 2018

Therapeutic Benefit

Risk of Bleeding

Line of Futility

3-Hour 6-Hour 4.5-Hour 24-Hour

TIME

Risk Ratio

12
Thrombectomy for Stroke at 6 to 16 Hours

MULTICENTER, RANDOMIZED, OPEN-LABEL TRIAL WITH SELECTION BY PERFUSION IMAGING

Thrombectomy + medical therapy

N = 92

Disability score at 90 days favoring thrombectomy (P < 0.001)

45% Functional independence at 90 days (P < 0.001)

7% Symptomatic intracranial hemorrhage within 36 hr (P = 0.75)

Artery occlusion and salvageable tissue

Medical therapy alone

N = 90

Disability score at 90 days favoring thrombectomy (P < 0.001)

45% Functional independence at 90 days (P < 0.001)

7% Symptomatic intracranial hemorrhage within 36 hr (P = 0.75)

The NEW ENGLAND JOURNAL of MEDICINE
Albers et al. 2018

NNT: (DAWN: 6-24 hours) = 3  (DEFUSE: 6-16 hours) = 2
Lower is better
Compared with PCI for STEMI (50)  CABG (25)
ISC Highlight #2: Promising Acute stroke treatment

b. Time vs Tissue… patients with target mismatch (small infarct core and large perfusion deficit) benefit from mechanical thrombectomy even if treatment is done beyond 6 hours, up to 24 hours from LKW.
## Expansion of Eligible Patients for Acute Stroke Intervention

<table>
<thead>
<tr>
<th>Time Window</th>
<th>% of Patients presenting in ED</th>
<th>Cumulative % of Patients Eligible for Acute Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 hour IV-TPA</td>
<td>20-25%</td>
<td>20-25%</td>
</tr>
<tr>
<td>3-4.5 hour Extended TPA</td>
<td>10-15%</td>
<td>30-40%</td>
</tr>
<tr>
<td>4.5-6 hour Mechanical Thrombectomy</td>
<td>10-15%</td>
<td>40-55%</td>
</tr>
<tr>
<td>6-4 hour Extended Mechanical Thrombectomy</td>
<td>20-30%</td>
<td>60-85%</td>
</tr>
</tbody>
</table>

Lacy et al. Stroke 2001;32:63-69
Clinical Criteria

■ Persistent neurological deficit

■ 6-16 hours (DEFUSE): NIHSS \( \geq 6 \)

■ 16-24 hour (DAWN): NIHSS \( \geq 10 \)
Imaging Criteria

A. Non-contrast CT ASPECTS
(Alberta Stroke Program Early CT Score)
Imaging Criteria

B. CT Perfusion – RAPID software

- 3 variables: Infarct Core, Penumbra, Mismatch

No Mismatch
Small Lesion Profile
Target Mismatch Profile
Malignant Profile
Imaging Criteria

B. CT Perfusion – RAPID software

No Mismatch: **NOT** candidate for thrombectomy
Imaging Criteria

B. CT Perfusion – RAPID software

Small Lesion Profile: NOT candidate for thrombectomy
Imaging Criteria

B. CT Perfusion – RAPID software

Target Mismatch Profile: Candidate for thrombectomy
Imaging Criteria

B. CT Perfusion – RAPID software

Malignant Profile: NOT candidate for thrombectomy
Candidate for Thrombectomy?

- 52M  LKW 15 hours ago

CBF < 30% volume: 8 ml
Mismatch volume: 28 ml
Mismatch ratio: 4.5

Tmax > 6.0s volume: 36 ml

Not for primary diagnosis.
Case 1

- 52M LKW 15 hours ago

**Imaging Profile:**
- CT-Perfusion: YES
- CT ASPECTS: NO
- CTA head: NO

**Clinical Profile:**
- NIHSS = 4 NO
Christmas Miracle

- 40M with Hx of HTN, Obesity, Diabetes, post-renal transplant, not on any antithrombotics
- 12/24/2017
  - LKW 2AM, Px woke up with HA but no weakness or focal signs
  - 4AM felt heaviness on left leg but did not seek help
  - 5PM Sister found px unable to walk and called 911
  - Oneida Hospital ED arrival 5:33PM
    - CT reported as unremarkable
    - NIHSS 7
    - Px referred to Upstate for transfer (35 miles away) Departure 6:22 PM
      (DIDO <60 min)
  - Arrived at Upstate 7PM
  - EMS transport reported worsening exam, NIHSS now 16
NCCT at 7:20PM (T+17hrs) ASPECTS 8
CTA / CTP 7:50PM
Clinical Criteria

- NIHSS 16  YES

Imaging Criteria

- Non Contrast CT ASPECTS 8  YES
- CTA Head R MCA/ICA occlusion  YES
- CT Perfusion/RAPID: Target Mismatch  YES
Cerebral Angio TICI 3 @9:45PM (LKW 2AM)

Pre-thrombectomy showing R MCA clot

Complete Recanalization

L MCA normal

20 hours from last known well
MRI 2 days later, NIHSS=1
(facial droop)

Patient discharged on Day 4 to home, NIHSS 1 (from 16)
THANK YOU