Endovascular Thrombectomy Outcomes in Large Core on CT Are Strongly Associated with Perfusion Core Volume and Time

Implications from Two Large Cohorts for Future Trials

Amrou Sarraj, M.D
Associate Professor,
Department of Neurology, UT McGovern Medical School, Houston
On Behalf of SELECT and TREVO Investigators
Financial Disclosures:

• Grant support: Stryker Neurovascular (SELECT & SELECT 2)
• Scientific Advisory board: Stryker Neurovascular
• Consultant and Speaker: Stryker Neurovascular
• UT-Memorial Hermann center PI for the TREVO registry
• UT-Memorial Hermann center PI for the DEFUSE 3 trial
• ASSIST registry steering committee
Authors

Amrou Sarraj\textsuperscript{1}, Ameer Hassan\textsuperscript{2}, Raul Nogueira\textsuperscript{3}, David Liebeskind\textsuperscript{4}, Nirav Vora\textsuperscript{5}, Michael Abraham\textsuperscript{6}, Sean Savitz\textsuperscript{1}, James Grotta\textsuperscript{1}, Clark Sitton\textsuperscript{1}, Blaise Baxter\textsuperscript{7}, Peng R Chen\textsuperscript{1}, Antonin Krajina\textsuperscript{8}, Chunyan Cai\textsuperscript{1}, Gary Cutter\textsuperscript{9}, Deep Pujara\textsuperscript{1}, Bita Imam\textsuperscript{1}, Joey English\textsuperscript{10}, Erol Veznedaroglu\textsuperscript{11}, Diogo Haussen\textsuperscript{3}, Maarten Lansberg\textsuperscript{12}, Rishi Gupta\textsuperscript{13}, Gregory Albers\textsuperscript{12}

\textsuperscript{1}UT Health Science Center at Houston, Houston, TX; \textsuperscript{2}Univ of Texas - Rio Grande Valley, Harlingen, TX; \textsuperscript{3}Emory University, Atlanta, GA; \textsuperscript{4}Univ of California Los Angeles, Los Angeles, CA; \textsuperscript{5}OhioHealth - Riverside Methodist Hosp, Columbus, OH; \textsuperscript{6}Univ of Kansas Medical Ctr, Kansas City, KS; \textsuperscript{7}Erlanger Hospital, Chattanooga, TN; \textsuperscript{8}Charles University, Hradec Kralove, Czech Republic; \textsuperscript{9}Univ of Alabama at Birmingham, Birmingham, AL; \textsuperscript{10}California Pacific Medical Center, San Francisco, CA; \textsuperscript{11}Drexel Neurosciences Institute, Philadelphia, PA; \textsuperscript{12}Stanford Univ, Stanford, CA; \textsuperscript{13}Wellstar Health System, Marietta, GA
Introduction

• Endovascular thrombectomy (EVT) efficacy and safety is established in patients with minimal ischemic changes:
  • ASPECTS ≥ 6
  • Small core on perfusion images
• Patients with significant ischemic changes (large core) were largely excluded from most trials
Ischemic Changes on Imaging Modalities

- Large core definition may differ between CT and CTP:
  - CT ASPECTS detects hypodense tissue
  - CTP identifies regions of very low blood flow or volume
Objective

• Evaluate the variability of EVT outcomes in patients with large core on CT in relation to:
  I. CTP core volume
  II. Time
• Prospective, cohort multicenter study of imaging selection prior to thrombectomy

• Unified imaging profile (CT, CT angiography, and CTP with mismatch determination using RAPID software) for all patients

• Blinded core lab evaluated all images

• Study arms (non-randomized):
  • Endovascular Thrombectomy
  • Medical Management

• A post-marketing registry

• Imaging obtained at the discretion of the investigators

• Blinded core lab evaluated all images

• Study arms:
  – Endovascular Thrombectomy
Methods

• **Inclusion criteria:**
  – Anterior Circulation LVO (ICA, MCA-M1/M2)
  – Large core on **CT ASPECTS 0-5**
  – NIHSS at presentation ≥ 6
  – LKW to procedure time 0-24 hours
  – Baseline mRS 0-1
• The analyses were performed on SELECT

• Validation on the combined cohort of SELECT and TREVO
SELECT Trial (N=445)

- Excluded (N=84)
  - Low NIHSS
  - Inadequate Imaging
  - Distal clot

ASPECTS 0-5 (N=187)

- rCBF(<30%) volume < 50cc: 64%
- rCBF(<30%) volume 50-100cc: 27%
- rCBF(<30%) volume > 100cc: 9%

TREVO registry (N=2031)

- Excluded (N=567)
  - Low NIHSS
  - High baseline mRS
  - Distal/posterior clot

- Excluded (N=77)
  - Medical management

- Excluded (N=247)
  - ASPECTS criteria not met

- Excluded (N=1304)
  - ASPECTS criteria not met
## Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>TREVO</th>
<th>SELECT</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>64.14(17.66)</td>
<td>63.68 (14.77)</td>
<td>0.89</td>
</tr>
<tr>
<td>Hypertension</td>
<td>66%</td>
<td>78%</td>
<td>0.18</td>
</tr>
<tr>
<td>Diabetes</td>
<td>31%</td>
<td>38%</td>
<td>0.46</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>19%</td>
<td>8%</td>
<td>0.24</td>
</tr>
<tr>
<td>Baseline NIHSS</td>
<td>17.8(5.4)</td>
<td>18.8 (5.0)</td>
<td>0.36</td>
</tr>
<tr>
<td>IV Lytics Administered</td>
<td>47%</td>
<td>70%</td>
<td>0.02</td>
</tr>
<tr>
<td>Clot location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICA</td>
<td>25%</td>
<td>30%</td>
<td>0.23</td>
</tr>
<tr>
<td>M1</td>
<td>58%</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>17%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Transfer Status</td>
<td>53%</td>
<td>51%</td>
<td>0.86</td>
</tr>
<tr>
<td>Time from LSN to procedure (min)</td>
<td>6.52(4.60)</td>
<td>5.15(2.70)</td>
<td>0.10</td>
</tr>
<tr>
<td>ASPECTS score</td>
<td>4.4 (0.7)</td>
<td>4.4(0.8)</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Good outcomes: 48% vs 20% vs 0%, p for trend=0.031
Symptomatic ICH: 4% vs 0% vs 75%, p for trend=0.002
Neurological Worsening: 4% vs 22% vs 100%, p for trend<0.001
Mortality: 4% vs 30% vs 50%, p for trend=0.009
Good outcomes: 45% vs 29% vs 11%, p for trend=0.018
Symptomatic ICH: 2% vs 7% vs 33%, p for trend=0.002
Neurological Worsening: 3% vs 18% vs 56%, p for trend<0.001
Mortality: 11% vs 29% vs 33%, p for trend=0.019
Probability Of Good Outcomes With Time And Volume (SELECT)
Probability Of Good Outcomes With Time And Volume (SELECT)
Probability Of Good Outcomes With Time And Volume (SELECT & TREVO)
Limitations

- No medical management controls
- No benefit conclusions can be made
- Unified imaging profile in SELECT
- Imaging selection by site investigators’ discretion in TREVO
Conclusion

• In patients with large core on CT, as the volumes increased and time to reperfusion progressed:
  I. The rates of functional independence declined
  II. Mortality and symptomatic hemorrhage rates increased

• Low rates of good outcomes with thrombectomy beyond 100 cc
  – May still be better than medical management thus RCTs are needed

• This data can help inform the design of future large core RCTs
SELECT 2

- Randomized, controlled trial assessing:
  I. Thrombectomy efficacy and safety in patients with unfavorable profiles on CT and perfusion images
  II. Correlation between imaging and thrombectomy outcomes

- 20 sites
  - US
  - International

- Large core
  - ASPECTS 3-5
  - rCBF (<30%) volume 50-100cc

- Enrollment goal: up to 460 patients
Evolution of Evidence and Population

Small Core - Early window (0-6 hours)

Small Core - late window (>6-24 hours)

Large Core

2015

2018

2021
Thank You

• Patients and their families
• Investigators, coordinators and steering committee
• Statistical team
• Stryker Neurovascular