Direct Aspiration Thrombectomy Technique for Acute Ischemic Stroke: Where do we stand?

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Disclosures

- Cerenovus—consulting, PI ANSWER trial, PI NAPA trial
- Penumbra – consulting, nonfinancial research support
- Minnetronix – consulting, nonfinancial research support

Landmark Clinical Trials

- IN 2015, FIVE major prospective, multicenter, randomized trials have been published in The New England Journal of Medicine comparing mechanical thrombectomy to best medical management:
  - MR CLEAN
  - ESCAPE
  - EXTEND-IA
  - SWIFT PRIME
  - REVASCAT

Latest Guidelines

In June 2015, the American Heart Association/American Stroke Association formulated new guidelines for the management of acute ischemic stroke patients based on the results of these new trials:

All eligible patients SHOULD receive IV tPA and mechanical thrombectomy

We now have level 1a evidence supporting the role of thrombectomy for acute ischemic stroke.

But we continued to advance the techniques in the meantime!
NEW Generation Catheters
TRACKABLE LARGE BORE ASPIRATION CATHETER

- Softer Tip
- More Flexible
- Improved Trackability

AS THE CATHETERS HAVE BECOME LARGER

MUSC Experience: 560 Direct Aspiration cases

064 068 ACE

Evolution of Penumbra Aspiration Catheters

Effect of catheter size (aspiration force)
No downside to larger catheters!

- Not only was there a new technique being developed during the Stent Retriever trials (Direct aspiration), it was also rapidly evolving and improving.

Background

Recent trials demonstrated improved patient outcomes with endovascular therapy, as compared to medical therapy, in the treatment of large vessel stroke.

The majority of patients in those trials were treated with stent retrievers.

Objective

To evaluate whether acute ischemic stroke (AIS) patients, treated with ADAPT approach within 6 hours of symptom onset do not have inferior clinical outcomes to those treated with a SRFL approach.

As well as to evaluate whether the ADAPT approach is technically superior, clinically superior, or more cost effective than SRFL approach in the treatment of AIS.

Background

Pilot data utilizing a direct aspiration first pass technique (ADAPT) approach suggest similar functional outcomes with superior technical results, while lowering procedure time and device costs versus traditional stent retriever as a first line (SRFL) approach.
Study Design
Design  Prospective, randomized, international, multi-center, blinded assessment concurrent controlled trial
Population Anterior circulation ELVO (ICA to MCA Bifurcation) within 6 hours of onset
Randomization 1:1 ADAPT vs SRFL
Sites Up to 20
Assessment Blinded core lab adjudication of imaging
Blinded mRS and NIHSS certified clinical assessment

Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>ADAPT</th>
<th>SRFL</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>71.8±13.1</td>
<td>71.1±12.9</td>
<td>0.84</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>57.3%</td>
<td>50%</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Baseline Characteristics

<table>
<thead>
<tr>
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<th>ADAPT</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Pre-morbid Modified Rankin Score (mRS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>81.3 (109/134)</td>
<td>76.5 (104/136)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>16.4 (22/134)</td>
<td>21.3 (20/136)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.5 (2/134)</td>
<td>0.7 (1/136)</td>
<td>1.33 (0.74, 2.39)</td>
</tr>
<tr>
<td>3</td>
<td>0 (0/134)</td>
<td>1.5 (2/136)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.7 (1/134)</td>
<td>0 (0/136)</td>
<td></td>
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</tbody>
</table>

Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>ADAPT</th>
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<tbody>
<tr>
<td>Medical History</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>68.7 (90/134)</td>
<td>75 (102/136)</td>
<td>0.28</td>
</tr>
<tr>
<td>Diabetes</td>
<td>26.9 (36/134)</td>
<td>29.4 (40/136)</td>
<td>0.69</td>
</tr>
<tr>
<td>Hyperlipidemia/Hypercholesterolemia</td>
<td>48.5 (65/134)</td>
<td>46.3 (63/136)</td>
<td>0.81</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>48.5 (65/134)</td>
<td>41.2 (56/136)</td>
<td>0.27</td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>23.1 (31/134)</td>
<td>22.1 (30/136)</td>
<td>0.88</td>
</tr>
<tr>
<td>Current Smoker</td>
<td>13.4 (18/134)</td>
<td>23.1 (30/136)</td>
<td>0.11</td>
</tr>
<tr>
<td>History of Ischemic Stroke</td>
<td>9.0 (12/134)</td>
<td>16.9 (23/136)</td>
<td>0.07</td>
</tr>
<tr>
<td>History of Hemorrhagic Stroke</td>
<td>2.2 (3/134)</td>
<td>0.7 (1/136)</td>
<td>0.37</td>
</tr>
<tr>
<td>History of TIA</td>
<td>5.2 (7/134)</td>
<td>5.9 (8/136)</td>
<td>1.00</td>
</tr>
<tr>
<td>History of untreated intracranial aneurysm(s)</td>
<td>3.0 (4/134)</td>
<td>0 (0/136)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Baseline Characteristics

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<thead>
<tr>
<th></th>
<th>ADAPT</th>
<th>SRFL</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Baseline NIHSS (median)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline NIHSS (mean)</td>
<td>16.9±5.8</td>
<td>16.9±6.3</td>
<td>0.99</td>
</tr>
<tr>
<td>Systolic Blood Pressure (median)</td>
<td>155</td>
<td>155</td>
<td></td>
</tr>
<tr>
<td>Systolic Blood Pressure (mean)</td>
<td>160.7±28.6</td>
<td>160.9±28.9</td>
<td>0.24</td>
</tr>
<tr>
<td>Baseline ASPECTS Score (median)</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Baseline ASPECTS Score (mean)</td>
<td>8.2±0.7</td>
<td>8.1±0.7</td>
<td>0.45</td>
</tr>
<tr>
<td>Laterality Left</td>
<td>48.5 (65/134)</td>
<td>45.2 (60/135)</td>
<td>0.63</td>
</tr>
<tr>
<td>Right</td>
<td>51.5 (69/134)</td>
<td>54.8 (74/135)</td>
<td></td>
</tr>
</tbody>
</table>

*One Basilar artery occlusion was incorrectly enrolled
Baseline Characteristics

<table>
<thead>
<tr>
<th>Site of Occlusion</th>
<th>ADAPT</th>
<th>SRFL</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCA M1 Proximal</td>
<td>61.2 (82/134)</td>
<td>63.2 (86/136)</td>
<td>0.80</td>
</tr>
<tr>
<td>M1 Distal</td>
<td>14.2 (19/134)</td>
<td>11.1 (15/136)</td>
<td>0.47</td>
</tr>
<tr>
<td>M1 Proximal</td>
<td>8.2 (11/134)</td>
<td>8.1 (11/136)</td>
<td>1.00</td>
</tr>
<tr>
<td>M1</td>
<td>0 (0/134)</td>
<td>0.7 (1/136)</td>
<td>1.00</td>
</tr>
<tr>
<td>ICA Supraclinoid ICA Terminus</td>
<td>13.4 (18/134)</td>
<td>15.4 (22/136)</td>
<td>0.73</td>
</tr>
<tr>
<td>Pterocavernous</td>
<td>0.7 (1/134)</td>
<td>0.7 (1/136)</td>
<td>1.00</td>
</tr>
<tr>
<td>Other Mid-basilar</td>
<td>0 (0/134)</td>
<td>0.7 (1/136)</td>
<td>1.00</td>
</tr>
<tr>
<td>Random Cervical-ICA</td>
<td>2.2 (3/134)</td>
<td>0 (0/136)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Primary Efficacy Endpoint

Functional outcome at 90d as defined by mRS 0-2

<table>
<thead>
<tr>
<th>Cohort</th>
<th>90d mRS 0-2</th>
<th>ADAPT non-Inferior</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRFL</td>
<td>49% (41.6, 57.4)</td>
<td>p = 0.14</td>
</tr>
<tr>
<td>ADAPT</td>
<td>52% (43.8, 60.3)</td>
<td></td>
</tr>
</tbody>
</table>

Pre-specified secondary outcomes:

- TICI 2b at final: 91.7% (122/133)*, 89% (121/136), P = 0.54
- TICI 2c at final: 56.4% (75/133), 55.9% (76/136), 1.0
- TICI 3 at final: 37.6% (50/133), 28.7% (39/136), 0.15

*One case had no imaging available for Core Lab Review, therefore excluded (the site reported TICI 3 outcome)

Outcomes

Secondary Efficacy Endpoints:

- 90d mRS Shift: OR (95% CI) = 0.98 (0.64, 1.51)
- TICI 2c or greater within 45 minutes: 50%, 44%, P = 0.2998
- TICI 3 or greater within 45 minutes: 34%, 23%, P = 0.0486
- Time to TICI 2b or greater: 22 min, 33 min, P = 0.0194

Safety Endpoints

- All cause mortality at 90 days: 22%, 22%, 1.02 (0.57, 1.81)
- All intracranial hemorrhage: 16%, 34%, 1.08 (0.63, 1.87)
- Symptomatic ICH (all ICH with NIHSS ≥4 worsening): 6.0%, 5.9%, 1.01 (0.37, 2.77)
- Symptomatic ICH (SITS-MOST criteria): 3.0%, 3.0%, 1.01 (0.25, 4.12)
### Cost Endpoint

<table>
<thead>
<tr>
<th>Cost Analysis</th>
<th>Treatment</th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficacy Endpoints</td>
<td>ADAPT (N=134)</td>
<td>Stent Retriever First Line (N=136)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Aggregate Supply Chain Data Primary, List Price Secondary</td>
<td>mean±sd $9,540±7,962</td>
<td>$14,081±4,797</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>median $6,633</td>
<td>$12,790</td>
<td>-</td>
</tr>
<tr>
<td>IQR $3,885</td>
<td>$3,458.3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>List Price Primary, Aggregate Supply Chain Data Secondary</td>
<td>mean±sd $10,084±8,873</td>
<td>$15,158±5,223</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>median $6,848</td>
<td>$13,686</td>
<td>-</td>
</tr>
<tr>
<td>IQR $3,651</td>
<td>$3,832</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### Conclusion

There is now Level I evidence that Stent Retrievers and Direct Aspiration have non-inferior clinical outcomes in the treatment of ELVO.

### Conclusions

1. ADAPT results in non-inferior functional outcomes as compared to a SRFL approach.
2. Success rates of reperfusion were comparable, but were achieved more quickly with ADAPT.
3. ADAPT associated with a significant cost savings.

### Take-Home Point

- Direct aspiration is an ideal front line modality for thrombectomy for Large Vessel Occlusion causing an acute ischemic stroke.

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THANK YOU