Endovascular Stroke Therapy

Update with Emphasis on Practical Clinical and Imaging Considerations

Sachin Kishore Pandey, MD, FRCPC
Disclosures

• I have no relevant financial disclosures or conflict of interest
Overview

• Review of the recent literature
  – Emphasis on what was studied, reasons for trial failures/successes and implications for imaging.

• Review Canadian practice guidelines

• Use the literature and national guidelines to develop a practical, acute imaging protocol
Recent Stroke Trials

• In addition to ESCAPE, 4 other major trials published in NEJM in 2015
  – MR CLEAN
  – EXTEND-IA
  – REVASCAT
  – SWIFT-PRIME
MR CLEAN

• Dutch trial published in NEJM December 2014

• 502 patients enrolled from 2010-2014
  – 18yrs old – No upper age limit
  – NIHSS >2
  – CTA confirmed anterior occlusion

• Treatments
  – IV tPa (or not) per standard guidelines
  – Allowed IA tPa and/or suction thrombectomy, stent-retriever, wire disruption
EXTEND-IA

• Australian trial published in NEJM March 2015
• 70 patients
  – CTA confirmed anterior occlusion
  – CTP confirmed ischemic penumbra
• Treatments
  – IV tPa per standard guidelines
  – Intervention - Solitaire stent-retriever only.
REVASCAT

• Spanish trial published in NEJM April 2015

• 206 patients
  – 18yrs old – 80 (85) yrs old
  – NIHSS >6
  – CTA confirmed anterior occlusion

• Treatments
  – IV tPa (or not) per standard guidelines
  – Intervention – Solitaire stent retriever only
SWIFT-PRIME

• International trial published in NEJM April 2015
• 196 patients
  – 18yrs old – 85yrs old
  – NIHSS >
  – CTA confirmed anterior occlusion
• Treatments
  – IV tPa (or not) per standard guidelines
  – Intervention – Solitaire stent retriever only
Trial Take Home Points

• All studies demonstrated statistically significant improvement in 90day mRs
• No study demonstrated statistically significant differences in 90day mortality or rates of symptomatic intracranial hemorrhage
Trial Take Home Points

• All patients subjected to endovascular treatment should be confirmed to have appropriate targets
• Timing is critical to good outcomes
• The use of modern stent-retriever devices improves our ability to open arteries
## SYMPTOM ONSET TO tPA ADMINISTRATION

<table>
<thead>
<tr>
<th>Trial</th>
<th>Standard Therapy</th>
<th>Endovascular + Standard Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCAPE</td>
<td>125 mins</td>
<td>110 mins</td>
</tr>
<tr>
<td>MR CLEAN</td>
<td>85 mins</td>
<td>87 mins</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>145 mins</td>
<td>127 mins</td>
</tr>
<tr>
<td>REVASCAT</td>
<td>105 mins</td>
<td>117 mins</td>
</tr>
<tr>
<td>SWIFT-PRIME</td>
<td>117 mins</td>
<td>111 mins</td>
</tr>
</tbody>
</table>
## SYMPTOM ONSET TO GROIN PUNCTURE

<table>
<thead>
<tr>
<th>Trial</th>
<th>Endovascular + Standard Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCAPE</td>
<td>185 mins</td>
</tr>
<tr>
<td>MR CLEAN</td>
<td>260 mins</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>210 mins</td>
</tr>
<tr>
<td>REVASCAT</td>
<td>269 mins</td>
</tr>
<tr>
<td>SWIFT-PRIME</td>
<td>224 mins</td>
</tr>
</tbody>
</table>
### TICI 2B/3 Rates

<table>
<thead>
<tr>
<th>Trial</th>
<th>Endovascular + Standard Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCAPE</td>
<td>72.4 %</td>
</tr>
<tr>
<td>MR CLEAN</td>
<td>59 %</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>86 %</td>
</tr>
<tr>
<td>REVASCAT</td>
<td>65.7 %</td>
</tr>
<tr>
<td>SWIFT-PRIME</td>
<td>88 %</td>
</tr>
</tbody>
</table>
For 1 Additional Patient with Independent Outcome

- ESCAPE - NNT 4
- EXTEND-IA - NNT 3.2
- REVASCAT - NNT 6.5
- SWIFT-PRIME - NNT 4
- MR CLEAN – NNT 7
- HERMES – NNT 2.6
Time is Brain

• SWIFT-PRIME
  – IA arm pts reperfused within 2.5hrs of symptom onset → **91%** estimated probability of functional independence
  – By 3.5hrs → **80%**
  – By 4.5hrs → **60%**
  – By 5.5hrs → **40%**
Time is Brain

• ESCAPE
  – For every 30 minute increase in CT-to-reperfusion time:
    • Probability of reaching a functionally independent outcome falls by 8.3%
So What Does This Mean For the Imaging?

• Our imaging must be:
  – FAST – To acquire and to interpret

• Our imaging must answer the following questions:
  – Should the patient be screened out of consideration?
  – Does the patient have the disease?
  – Should the patient be treated?
Canadian Best Practice Recommendations - Patient Timelines

• All pts with disabling acute ischemic stroke must screened without delay to determine eligibility for IV tPA (within 4.5hrs) and/or IA therapy (within 6hrs)
Canadian Best Practice Recommendations - Imaging

• Non-contrast CT – Identify small-to-moderate ischemic ‘core’ (ASPECTS 6 or higher)

• Endovascular candidates – CTA must demonstrate proximal anterior circulation occlusion
  – ‘Strongly recommended’ that pts have evidence of moderate-to-good collaterals on CTA or CT perfusion ‘mismatch’
Hyperacute Stroke Imaging – Practical Approach

• Non-contrast CT
  – Is there acute hemorrhage?
  – Is there a large, established stroke (ie. poor ASPECTS)?
Hyperacute Stroke Imaging – Practical Approach

- CT Angiogram – Head and Neck
  - Is there a proximal large vessel occlusion?
  - Are there any additional proximal occlusions (ie. cervical carotid) or anatomic variants?
Hyperacute Stroke Imaging – Practical Approach

• ‘Multi-phase’ CT angiogram
  – Normal CT angiogram followed by 2 additional scans from the skull base to vertex only
  – No additional contrast needed
  – Additional radiation dose of ~1mSv
  – Basic Question – Are there moderate-to-good collaterals?
Radiation Dose Context

- Annual background – 1.8 mSv/yr
- Chest CT – 7 mSv
- “Kitchen-sink” stroke CT – 12 mSv
- Annual dose limit for nuclear workers – 50 mSv
- Avg annual exposure to astronaut – 150 mSv
- Radiation sickness symptoms – 1000 mSv
Hyperacute Stroke Imaging – Practical Summary

• Screening
  – NC Head – Hemorrhage? ASPECTS?
  – CTA Head/Neck – Proximal large vessel occlusion?

• Decision to Treat
  – Multiphase CTA – Good collaterals?
Canadian Best Practice Recommendations – Clinical Timelines

• Time from Door to t-PA of 30 minutes (median) with 90\textsuperscript{th} percentile of 60 minutes

• Time from CT to Groin Puncture of 60 minutes
Mechanical Thrombectomy - Devices

• Retrievable stents
  – Solitaire (Medtronic)
  – Trevo (Stryker)

• Aspiration catheters
  – Penumbra

• Both
Overview

• Review of the recent literature
  – Emphasis on what was studied, reasons for trial failures/successes and implications for imaging.

• Review Canadian practice guidelines

• Use the literature and national guidelines to develop a practical, acute imaging protocol
References

• Mechanical thrombectomy for patients with acute ischemic stroke: OHTAC Recommendation. September 2015; pp 1-4 - DRAFT
• Menon et al. Multiphase CT angiography: a new tool for the imaging triage of patients with acute ischemic stroke. Radiology 2015; Vol 275: Number 2
• Menon et al. Imaging paradigms in acute ischemic stroke: a pragmatic evidence-based approach. Radiology 2015; Vol 277: Number 1
Thank You!