Thrombectomy for Large Vessels Occlusion: How Does Imaging Influence Triage?

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Disclosure

• I have no financial conflict of interest to disclose for the content of this lecture.

• I use Rapid Software for Hyper-acute Stroke detection.
Learning Objectives

1) Review the imaging inclusion criteria for Thrombectomy candidates up to 24 hours;
2) Illustrate the role of CTP using Rapid software and other CTP programs;
3) Discuss management of exemplary cases;
4) Recommend a practical algorithm for patient’s management.
## Summary Results of Trials for EVT up to 12 hours

<table>
<thead>
<tr>
<th></th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
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<tbody>
<tr>
<td>Pts</td>
<td>500</td>
<td>316</td>
<td>70</td>
<td>196</td>
<td>206</td>
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<tr>
<td>Circulation</td>
<td>Anterior</td>
<td>Anterior</td>
<td>Anterior</td>
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<tr>
<td>Imaging</td>
<td>CT-CTA</td>
<td>CT-CTA</td>
<td>CT-CTA-CTP</td>
<td>CT-CTA-CTP</td>
<td>CT-CTA</td>
</tr>
<tr>
<td>Time Window</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Pt's Age</td>
<td>65</td>
<td>70</td>
<td>69</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>RANDOMIZATION</td>
<td>ENDO</td>
<td>CTRL</td>
<td>ENDO</td>
<td>CTRL</td>
<td>ENDO</td>
</tr>
<tr>
<td>NIHSS</td>
<td>17</td>
<td>18</td>
<td>16</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>IV-TPA (%)</td>
<td>87.1</td>
<td>90.6</td>
<td>72.7</td>
<td>78.7</td>
<td>100%</td>
</tr>
<tr>
<td>Perfusion Delay (h)</td>
<td>5.5</td>
<td>4.0</td>
<td>4.1</td>
<td>4.2</td>
<td>5.9</td>
</tr>
<tr>
<td>mRS 0-2 at 90days (%)</td>
<td>32.6</td>
<td>19.1</td>
<td>53</td>
<td>29.3</td>
<td>71.4</td>
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<tr>
<td>NNT</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Symptomatic ICH</td>
<td>7.7</td>
<td>6.4</td>
<td>3.6</td>
<td>2.7</td>
<td>0</td>
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<tr>
<td>Death at 90 days (%)</td>
<td>18.9</td>
<td>18.4</td>
<td>10.4</td>
<td>19</td>
<td>9</td>
</tr>
</tbody>
</table>
## Summary Trials 6 to 24 hours

<table>
<thead>
<tr>
<th></th>
<th>DAWN*</th>
<th>DEFUSE 3**</th>
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</thead>
<tbody>
<tr>
<td>Pts</td>
<td>206</td>
<td>182</td>
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<tr>
<td>Circulation</td>
<td>Anterior</td>
<td>Anterior</td>
</tr>
<tr>
<td>Imaging</td>
<td>CTP-DWI</td>
<td>Rapid Software CT or MRI</td>
</tr>
<tr>
<td>Time Window</td>
<td>6-24</td>
<td>6-16</td>
</tr>
<tr>
<td>Pt’s Age/NIHSS/Core Infarct Vol</td>
<td>Group A &gt;80 / 10 or&gt; / &lt;21ml. Group B &lt;80/10 or&gt; / &lt;31ml. Group C &lt;80/20 or&gt; / &gt;31ml, &lt;51ml.</td>
<td>70 71 Infarct Core &lt;70ml Mismatch 1.8 or &gt;</td>
</tr>
<tr>
<td>RANDOMIZATION</td>
<td>ENDO</td>
<td>CTRL</td>
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<tr>
<td></td>
<td>ENDO</td>
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<tr>
<td>NIHSS</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>mRS 0-2 at 90days (%)</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td>Symptomatic ICH (%)</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Death at 90 days(%)</td>
<td>19</td>
<td>18</td>
</tr>
</tbody>
</table>


Selection Criteria

- **P** – Parenchyma: ASPECT 6 or more;
- **P** – Pipes: ICA,M1, may consider M2;
- **C** – Collaterals: present.

CTA Neck 60cc
Comparison of Perfusion CT Software to Predict the Final Infarct Volume After Thrombectomy

Friederike Austein, MD; Christian Riedel, MD; Tina Kerby, PhD; Johannes Meyne, MD; Andreas Binder, MD; Thomas Lindner, MSc; Monika Huhndorf, MD; Fritz Wodarg, MD; Olav Jansen, MD, PhD

Background and Purpose—Computed tomographic perfusion represents an interesting physiological imaging modality to select patients for reperfusion therapy in acute ischemic stroke. The purpose of our study was to determine the accuracy of different commercial perfusion CT software packages (Philips (A), Siemens (B), and RAPID (C)) to predict the final infarct volume (FIV) after mechanical thrombectomy.

Methods—Single-institutional computed tomographic perfusion data from 147 mechanically recanalized acute ischemic stroke patients were postprocessed. Ischemic core and FIV were compared about thrombolysis in cerebral infarction (TICI) score and time interval to reperfusion. FIV was measured at follow-up imaging between days 1 and 8 after stroke.

Results—in 118 successfully recanalized patients (TICI 2b/3), a moderately to strongly positive correlation was observed between ischemic core and FIV. The highest accuracy and best correlation are shown in early and fully recanalized patients (Pearson r for A=0.42, B=0.64, and C=0.83; P<0.001). Bland–Altman plots and boxplots demonstrate smaller ranges in package C than in A and B. Significant differences were found between the packages about over- and underestimation of the ischemic core. Package A, compared with B and C, estimated more than twice as many patients with a malignant stroke profile (P<0.001). Package C best predicted hypoperfusion volume in nonsuccessfully recanalized patients.

Conclusions—Our study demonstrates best accuracy and approximation between the results of a fully automated software (RAPID) and FIV, especially in early and fully recanalized patients. Furthermore, this software package overestimated the FIV to a significantly lower degree and estimated a malignant mismatch profile less often than other software. *(Stroke. 2016;47:2311-2317. DOI: 10.1161/STROKEAHA.116.013147.)*
Imaging

- Imaging plays a central role in triage of patients with early hyper-acute stroke (0-6 hours) and late (6-24 hrs) presentation.
- Large amount of imaging acquired.
- Few critical features to assess:
  - ASPECT score,
  - LVO,
  - Size of infarct core and Mismatch,
  - Location of the Stroke,
  - Clinical findings (NE, mRS, co-morbidities).
19 year-old female patient with right arm weakness
Case #1: 36 years old female.
Presenting with left hemiplegia and aphasia, stroke un-witnessed.
NIHSS 24

NIHSS 24

ASPECT Score 4/10

CTA:
Rt M1 occlusion

Collaterals: Adequate
CTP
Is this patient an IV TPA candidate?
Is this patient a good thrombectomy candidate?

CBF
CBV
TTP
Case #1
Large Infarct Core without any viable penumbra.

- Un-witnessed event $\rightarrow$ No IV TPA
- ASPECT score 4/10 $\rightarrow$ No EVT
- No mismatch on CTP $\rightarrow$ No EVT.
Evolution

One day later

Two Days later

Three days later

F/U at 8 months
Case #2:

83 years old male, transferred from another hospital. Patient has received IV TPA. He presents fluctuating symptoms of right hemiplegia, aphasia and facial droop for past 2 hours.

NIHSS 22

ASPECT score 10/10
CTA and Collaterals

Is this patient a candidate for Thrombectomy?

Yes

Not
Angiography: complete recanalization, EVT not performed,

Recanalization with IV TPA

Thrombus > 8mm  0
Thrombus 0 - 5 mm  42%

Case # 3: 82 years old male patient, right hemiplegia and speech impairment, NIHSS 17.

ASPECT score 10/10
CTA and CTP
CTA neck: no carotid stenosis, left M1 stenosis
CT f/u 10 days later

**WASID:** ASA effective and safer than Warfin to prevent recurrent stroke
High recurrence stroke rate if stenosis is 70-99%.*

**SAMMPRIS:** aggressive medical treatment superior to PTAS, high level of peri-procedural stroke.**

** Cderdeyn et al. Lancet 2014, 383:333-341
57 y.o. Male
Lt MCA syndrome
NIHSS23
Last seen normal
at 9:00 am.
CTA done at 6:33 pm.
CBF<30% volume: 15 ml

Mismatch volume: 5 ml
Mismatch ratio: 1.3

Tmax>6.0s volume: 20 ml

RAPID
58 y.o. Female, Left Hemiparesis
RAPID

CBF < 30% volume: 0 ml
Mismatch volume: 0 ml
Mismatch ratio: none
Tmax > 6.0s volume: 0 ml
85 y.o. Male
Rt. Hemiplegia @6:00pm

CT @7:00pm

CT @7:00pm
85 y.o. Male
Rt. Hemiplegia @6:00pm

CT @11:00pm
CBF<30% volume: 26 ml

Mismatch volume: 85 ml
Mismatch ratio: 4.3

Tmax>6.0s volume: 111 ml
Conclusions

• The success of revascularization in hyperacute stroke (0-24 Hours) is linked to imaging;
• The CTP has expanded the window of opportunity for successful thrombectomy;
• Be practical, no time to lose:
  From 0-6 Hours: CT- CTA Willis-CTP-CTA Neck
  From 6-24 Hours: CT- CTP- CTA Willis- CTA Neck

Ask pertinent clinical information:
  1. mRS at baseline (usually patient loses one point at the time of a stroke);
  2. NIHSS (eloquent vs non-eloquent stroke territory);
  3. co-morbidities.

Do not engage in futile interventions!
MRI in the Thousand Islands
1st Annual MRI Anatomy & Pathology Course
October 4-5, 2019
Four Points Sheraton Hotel
Kingston, Ontario, Canada

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This program is a practical MRI anatomy and pathology symposium. We aim to highlight current trends and recent advances in MRI in various body sections through didactic and interactive case-based sessions. Program highlights include:
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- Liver and Women’s Imaging
- Neuroradiology, including Epilepsy, Orbital, Spine, and Cranial Nerves
- Musculoskeletal Imaging of Large Joints
- Cardiac MRI
- Prostate MRI
- Contrast Agents
- Tailored Protocols

Guest Speakers
Dr. Robert Blankley
Musculoskeletal Radiologist
University of Toronto

Dr. Claudia Kirsch
Neuroradiologist
Zucker HfPste School of Medicine at Northwell

Dr. Roberta LaPiana
Pediatric Neurologist
MNI - McGill University

Dr. Nicole Schrader
Abdominal Imaging Radiologist
University of Ottawa

Conference Co-Chairs
Eric Dufresne, MD FRCP(C), Professor of Radiology
Kingston Health Sciences Centre, Queen’s University

Cédric Tabone, MD, PhD, Professor of Radiology
Kingston Health Sciences Centre, Queen’s University

Credits for Specialists
This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada, and approved by Queen’s University. You may claim a maximum of 11.5 hours (credits are automatically calculated)
Thank You!

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