Interventional Stroke Treatment
Fundamental Trials and Methods

Karl-Titus Hoffmann
Department of Neuroradiologie
Your preferred selection?
A guide to choose the very best ...
Fundamental Trials … and other experiences

1995 NINDS / ECASS
Start of i.v. thrombolysis

2008 ECASS III
i.v tPA time window extended to 4.5h

2013 IMS III / SYNTHESIS / MR RESCUE
Three trials fail to show superiority of endovascular recanalization over i.v. tPA using outdated techniques

1995
1999 PROACT II
Local application of Urokinase

2000

2005
2008 Stent Retriever
First off-label use of the Solitaire Stent for acute stroke treatment

2010
2015
2014/15 MR CLEAN / ESCAPE / EXTEND-IA / SWIFT PRIME / REVASCAT
5 trials show that stent retriever based endovascular stroke treatment is significantly superior to i.v. tPA alone in a time window of at least 6h

Lessons from the past:

Aspiration/Fragmentation

- excellent recanalisation
- clinical outcome worse

Why?
- Transformation of prox. into distal occlusion
- Occlusion of collaterals
Individual Collaterals

Nogueira et al. Stroke 2009
Individual result
# Inclusion Criteria

<table>
<thead>
<tr>
<th>Time window</th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6h</td>
<td>12h</td>
<td>6h (nach 8h beendet)</td>
<td>6h</td>
<td>8h</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NIHSS</th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2</td>
<td>Egal</td>
<td>Egal</td>
<td>&gt;=8 und &lt;30</td>
<td>&gt;=6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Imaging</th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCCT + CTA / MRT + MRA / DSA</td>
<td>NCCT + CTA</td>
<td>NCCT + CTA + CTP</td>
<td>NCCT + CTA / MRT + MRA (Perfusion in 71 Patients)</td>
<td>NCCT + CTA / MRT + MRA (Perfusion optional)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occlusion &amp; Repair</th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid-T, M1-2, A1-2; ICA Stent+PTA allowed</td>
<td>Carotid-T, M1-2; ICA Stent+PTA allowed</td>
<td>Carotid-T, M1-2; ICA Stent+PTA allowed</td>
<td>Carotid-T, M1; only PTA of ICA</td>
<td>Carotid-T, M1; ICA Stent+PTA allowed</td>
<td></td>
</tr>
</tbody>
</table>
## Intervention

<table>
<thead>
<tr>
<th></th>
<th>MR CLEAN</th>
<th>ESCAPE</th>
<th>EXTEND-IA</th>
<th>SWIFT-PRIME</th>
<th>REVASCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>i.v. tPA</strong></td>
<td>Not mandatory</td>
<td>Not mandatory</td>
<td>Obligatory</td>
<td>Obligatory</td>
<td>Obligatory (IA treatment when 30 min w/o improvement)</td>
</tr>
<tr>
<td><strong>Device</strong></td>
<td>81.5% Stentriever</td>
<td>86.1% Stentriever</td>
<td>Solitaire</td>
<td>Solitaire</td>
<td>Solitaire</td>
</tr>
<tr>
<td><strong>Anesthesia</strong></td>
<td>37.8% GA</td>
<td>9.1% GA</td>
<td>36% GA</td>
<td>37% GA</td>
<td>6,7% GA</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onset - tPA</td>
<td>86</td>
<td>115</td>
<td>145</td>
<td>117</td>
<td>110</td>
</tr>
<tr>
<td>Onset - Groin</td>
<td>260</td>
<td>185</td>
<td>210</td>
<td>224</td>
<td>269</td>
</tr>
<tr>
<td>Image - Groin</td>
<td>?</td>
<td>51</td>
<td>93</td>
<td>57</td>
<td>77</td>
</tr>
<tr>
<td>Onset - Reperfusion</td>
<td>?</td>
<td>241</td>
<td>248</td>
<td>252</td>
<td>355</td>
</tr>
</tbody>
</table>
Results

Number needed to treat: 3-4
Time to Treatment With Endovascular Thrombectomy and Outcomes From Ischemic Stroke: A Meta-analysis


Pooled data from 1287 patients out of 5 randomized trials

Compared ET+MT with MT
After 7.3 h no significant benefit from thrombectomy.
3 Questions

• Major vessel occlusion?
  ➔ Indication

• Already major infarct?
  ➔ Complications and Outcome

• How much tissue can be saved?
  ➔ Outcome
Major vessel occlusion?

75 J., f., time from onset: 1h 10´ left-hemispherical syndrome, NIHSS>10
Thrombus location and outcome (IVT)

- Distance to Thrombus

- A. cerebri media-Occlusion (n=136 - SITS-MOST-Criteria)
- rtPA i.v. - outcome (7d NIHSS, 90d mRS)

• DT > 16 mm → probability > 50% mRS ≤ 2 (90 d)

Is there already a major infarct?

Increased risk of
- sICH
- poor clinical outcome
• 72 J., m., i.a. Lysis, TE, Stent-PTA
How much tissue can be saved?

**Indicators - not evidenced**

Multiparametric Imaging

CT-Perfusion analysis

Concept of **Mismatch**
Endovascular stroke treatment (by stent retrievers) is efficient.

Time remains important – fixed time windows may fall away.

Competent implementation remains centered to (neuro)vascular units.

The adjustment of procedures and resources is required.
Interventional Stroke Treatment
Fundamental Trials and Methods

Karl-Titus Hoffmann
Department of Neuroradiologie