State-of-the-Art Treatment for Acute Ischemic Stroke

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State-of-the-Art Endovascular Treatment of Acute Ischemic Stroke

- Scientific evidence
- Guidelines
- Protocol
State-of-the-Art Endovascular Treatment of Acute Ischemic Stroke

- Scientific evidence
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- Protocol
Endovascular treatment versus medical treatment [including IV rt-PA]

Time window for recruitment in 15 trials


<3 hours  IMS III

<4.5 hours  SWIFT-PRIME

<6 hours  MR-CLEAN, EXTEND IA, SYNTHESIS-EXPANSION, SYNTHESIS-PILOT, MELT, PROACT I/II, Ducrocq et al.

<8 hours  REVASCAT, MR-RESCUE, Roubec et al.

12-24 hours  ESCAPE, Macleod et al.
Meta-analysis: 15 trials
2949 subjects analyzed—90 d outcomes

Modified Rankin scale [0-2]
0 (no symptoms),
1 (no significant disability),
or 2 (slight disability)

Modified Rankin scale [0-1]
0 (no symptoms),
1 (no significant disability)

Survival

Odds ratio


Favor medical

Favor endovascular
Meta-analysis: 15 trials
2949 subjects analyzed—90 d outcomes

Modified Rankin scale [0-2]
0 (no symptoms),
1 (no significant disability),
or 2 (slight disability)

Modified Rankin scale [0-1]
0 (no symptoms),
1 (no significant disability)

Odds of achieving a favorable outcome or excellent outcome at 3 months post-randomization is approximately 80% higher with endovascular treatment among patients with acute ischemic stroke.

Meta-analysis: 15 trials
90 d outcomes—modified Rankin Scale 0-2

Permitted IV rt-PA prior to endovascular Rx

Did not permit IV rt-PA prior to endovascular Rx

<table>
<thead>
<tr>
<th>Odds ratio</th>
<th>Favor medical</th>
<th>Favor endovascular</th>
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<tbody>
<tr>
<td>2.1, 95% CI 1.4–3.1</td>
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<tr>
<td>1.5, 95% CI 0.9–2.3</td>
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Odds of achieving a favorable outcome at 3 months post-randomization higher with endovascular Rx even in pts who already received IV rt-PA.
Meta-analysis: 15 trials
2906 subjects analyzed—Safety endpoints

Post-procedure symptomatic intracerebral hemorrhage

Odds ratio

1.2, 95% CI 0.8–1.7

No significant difference in comparable patients


Favor medical
Favor endovascular
The 2015 American Heart Association (AHA)/American Stroke Association (ASA) focused update:

“Acute ischemic stroke patients should receive endovascular treatment with a stent retriever if treatment can be initiated (groin puncture) within 6 hours of symptom onset”.

- Almost all data is derived from clinical trials that recruited patients within 6-8 hours of symptom onset.
Assessment of tissue viability on CT/MR perfusion images

$rCBF$  $rCBV$  $DWI-/MRI$
DAWN Trial (6-24 hrs symptom onset)

<table>
<thead>
<tr>
<th>Large artery occlusion+ CT/MR perfusion</th>
<th>Age ≥ 80yrs NIHSS ≥ 10</th>
<th>Infarct core &lt; 21 ml</th>
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<tr>
<td>Age &lt; 80yrs NIHSS ≥ 10</td>
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<td>Infarct core &lt; 51 ml</td>
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<td>Age &lt; 80yrs NIHSS ≥ 20</td>
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<td>Infarct core 31-49 ml</td>
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Modified Rankin Scale 0-2 at 3 m

Mechanical Thrombectomy N=107

48.6%

Control Group N=99

13.1%
DAWN Trial (6-24 hrs symptom onset)

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Mechanical Thrombectomy N=107
Control Group N=99

mRS 0-2 at 3 m

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<th>Overall</th>
<th>6-12 hrs</th>
<th>12-24 hrs</th>
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<td>48.6%</td>
<td>55.1%</td>
<td>43.1%</td>
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<tr>
<td></td>
<td>13.1%</td>
<td>20.0%</td>
<td>7.4%</td>
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DEFUSE 3 Trial (6-16 hrs symptom onset)


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<th>Large artery occlusion+ CT/MR perfusion</th>
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<td>Ratio of the volume of ischemic tissue on perfusion imaging to infarct volume &gt; 1.8</td>
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Mechanical Thrombectomy
N=92

Control Group
N=90

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<th>Control Group</th>
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<tr>
<td>mRS 0-2 at 3 m</td>
<td>45%</td>
<td>17%</td>
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<tr>
<td>Mortality at 3 m</td>
<td>14%</td>
<td>26%</td>
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</table>
DEFUSE 3 Trial (6-16 hrs symptom onset)


Large artery occlusion + CT/MR perfusion

Infarct size < 70 ml

Ratio of the volume of ischemic tissue on perfusion imaging to infarct volume >1.8

Control Group
N=90

<9 hrs 40% 28%
9-12 hrs 50% 17%
>12 hrs 42% 7%

mRS 0-2 at 90 d
N=92

Mechanical Thrombectomy
Quantitative/automated assessment of salvageable tissue (infarct/penumbra)

Volume of ischemic core, 23 ml

Volume of perfusion lesion, 128 ml

Mismatch volume, 105 ml

Mismatch ratio, 5.6
Quantitative/automated assessment of salvageable tissue (infarct/penumbra)

- Volume of ischemic core, 23 ml
- Mismatch volume, 105 ml
- Mismatch ratio, 5.6
- Volume of perfusion lesion, 128 ml

Quantitative/automated assessment and avoidance of intra-arterial thrombolytics is key to success.
State-of-the-Art Endovascular Treatment of Acute Ischemic Stroke

- Scientific evidence
- Guidelines
- Protocol
Patients eligible for intravenous rt PA should receive intravenous rt PA even if IA treatments are being considered.  

IA fibrinolysis is beneficial for treatment of carefully selected patients with major ischemic strokes of <6 hours’ duration caused by occlusions of the MCA.
### 2015 American Heart Association/American Stroke Association Focused Update

*Stroke. 2015; 46: 3020-3035*

<table>
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<tr>
<th>Evidence</th>
<th>Recommendations</th>
</tr>
</thead>
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<th>Class I; Level of Evidence A</th>
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**Patients eligible for intravenous rt PA should receive intravenous rt PA even if IA treatments are being considered.**

**Patients should receive endovascular therapy with a stent retriever if:**

- a. Prestroke mRS score 0 to 1,
- b. Receiving intravenous r-tPA < 4.5 hrs,
- c. Causative occlusion of the ICA or proximal MCA (M1),
- d. Age ≥ 18 years,
- e. NIHSS score of ≥ 6,
- f. ASPECTS of ≥ 6, and
- g. Treatment can be initiated (groin puncture) within 6 hours of symptom onset

**Class I; Level of Evidence A**

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**Note:**

- rt PA: recombinant tissue plasminogen activator
- IA: intra-arterial
- mRS: modified Rankin Scale
- NIHSS: National Institutes of Health Stroke Scale
- ASPECTS: Alberta Stroke Program Early CT Score
### 2018 American Heart Association/American Stroke Update *(Stroke. 2018;49:e46-e99)*

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<td>Patients eligible for intravenous rt PA should receive intravenous rt PA.</td>
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<td>Patients should receive endovascular therapy with a stent retriever if meet criteria specified in 2015 guidelines</td>
<td>Class I; Level of Evidence A</td>
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<td><strong>Mechanical thrombectomy in selected acute stroke patients within 6-16 hours of last known normal who have a large vessel occlusion in the anterior circulation and meet other DAWN/DEFUSE 3 eligibility criteria,</strong></td>
<td>Recommend</td>
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<td><strong>Mechanical thrombectomy with stent retriever in selected acute stroke patients within 6-24 hours of last known normal who have large vessel occlusion in the anterior circulation and meet other DAWN eligibility criteria,</strong></td>
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State-of-the-Art Endovascular Treatment of Acute Ischemic Stroke

Scientific evidence

Guidelines

Protocol
Protocol for acute ischemic stroke treatment
Qureshi AI, Georgiadis AL: Textbook of Interventional Neurology 2011: Cambridge, UK

Ischemic stroke

0-4.5hrs
IV thrombolysis
NIHSS score <10

3-6 hrs

NIHSS score ≥10

>6 hrs
CT/MRI Perfusion-Volume mismatch

Endovascular treatment (mechanical/pharmacological approach)
Protocol for acute ischemic stroke treatment

New protocol -- 2016

Ischemic stroke

0-4.5hrs
- IV thrombolysis (NIHSS score <10)

3-6 hrs
- CT angiogram occlusion -
- CT angiogram occlusion +

>6 hrs
- CT angiogram occlusion +
- Collaterals +
- Ischemic changes on CT-

Endovascular treatment (stent retrievers/pharmacological approach)
SHORT PROCEDURE
Protocol for acute ischemic stroke treatment
Newest protocol--2018

Ischemic stroke

0-4.5hrs
IV thrombolysis

CT angiogram occlusion -

CT angiogram occlusion +

CT angiogram occlusion +

Endovascular treatment (stent retrievers/pharmacological approach)
SHORT PROCEDURE

3-6 hrs

CT angiogram occlusion +

CT angiogram occlusion +

Infarct core/perfusion quantitative assessment

>6 hrs
Conclusions

- Recent clinical trials have demonstrated a significant benefit with endovascular treatment in patients with acute ischemic stroke using unique patient selection criteria and treatment paradigms.

- Large magnitude benefits can be expected with implementation of “parameter optimized endovascular treatment (RAPID TIME TO TREATMENT+FAST PROCEDURE TIME+HIGH RECANALIZATION RATES)” in patients with ischemic stroke who are candidates for IV thrombolytics.

- Large magnitude benefits can be expected with implementation of “selection based on quantitative assessment of penumbra/infarct core” in patients with ischemic stroke 6-24 hrs after symptom onset.
Zeenat Qureshi Institutes 2021—Thank you

St. Cloud, Minnesota, USA
Donka National Hosp, Conakry, Guinea
Firat University, Elasig, Turkey
Xuan Wu Hosp, Beijing, China