Endovascular Clot Retrieval

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Neurologist (and Stroke enthusiast)
Christchurch Hospital

2 November 2017
‘Something you can do tomorrow’

Melbourne half marathon 2016

2 November 2017
The past is a foreign country; they do things differently there.

(L. P. Hartley)
In 2009......

Clot Busters
Can we talk the talk ...and walk the walk?

Teddy Wu
Pauline Owens
Ajay Kumar
Geoff Green

2 November 2017
Simple approach to stroke
- blocked artery, unhappy brain

2 November 2017
Progressive loss of viable brain tissue
Clot in left middle cerebral artery

CT with MCA clot

CT angiogram – blocked vessel
Ischaemic penumbra
Penumbral salvage and recovery

Angiogram

Repeat CT scan
Patient with ischaemic penumbra

CT with MCA clot

CT perfusion with ischaemic penumbra

2 November 2017
Failed reperfusion, infarct progression

Angiogram

MRI DWI

2 November 2017
Time is brain - thrombolysis

Numbers needed to treat 90 day independence

4  9  14

Odds ratio (95% CI)

Treatment delay (h)

Emerson Lancet 2014
### Efficacy of thrombolysis

<table>
<thead>
<tr>
<th>Site of occlusion</th>
<th>Success at 2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid terminus</td>
<td>5%</td>
</tr>
<tr>
<td>MCA M1</td>
<td>30%</td>
</tr>
<tr>
<td>MCA M2</td>
<td>42%</td>
</tr>
<tr>
<td>Basilar</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td><strong>30%</strong></td>
</tr>
</tbody>
</table>

Saqqur Stroke 2007 & Bhatia Stroke 2010
Endovascular clot retrieval

2 November 2017
First successful clot retrieval patient in NZ
(Auckland City Hospital 2013)

The 52 year old woman presents with R MCA syndrome.
First successful clot retrieval patient in NZ (Auckland City Hospital 2013)

The 52 year old woman presents with R MCA syndrome.

Discharged day 4 after admission
<table>
<thead>
<tr>
<th>Study (2013 NEJM)</th>
<th>Patients</th>
<th>Treatment</th>
<th>IA Independent</th>
<th>Control independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR RESCUE</td>
<td>127</td>
<td>best Rx</td>
<td>31.6%</td>
<td>30.5%</td>
</tr>
<tr>
<td>SYNTHESES</td>
<td>362</td>
<td>IA vs IV</td>
<td>42%</td>
<td>46.4%</td>
</tr>
<tr>
<td>IMS III</td>
<td>656</td>
<td>IV</td>
<td>40.8%</td>
<td>38.7%</td>
</tr>
</tbody>
</table>

Inconsistent selection criteria
Old technology / devices
## Endovascular clot retrieval trials (NEJM 2015)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Artery opened</th>
<th>Independent (%)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR CLEAN</td>
<td>59%</td>
<td>33% vs 19%</td>
<td>21% vs 22%</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>86%</td>
<td>71% vs 40%</td>
<td>9% vs 20%</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>72%</td>
<td>53% vs 29%</td>
<td>10% vs 19%</td>
</tr>
<tr>
<td>SWIFT PRIME</td>
<td>88%</td>
<td>60% vs 36%</td>
<td>9% vs 12%</td>
</tr>
<tr>
<td>REVASCAT</td>
<td>66%</td>
<td>44% vs 28%</td>
<td>18% vs 16%</td>
</tr>
</tbody>
</table>

Around double the rate of independent outcome
NNT 4 – 7 for 90 day independence
Mortality reduction up to 50%

2 November 2017
Time is brain
- clot retrieval
ABSTRACT

Objective: To quantify the patient lifetime benefits gained from reduced delays in endovascular therapy for acute ischemic stroke.

Methods: We used observational prospective data of consecutive stroke patients treated with IV thrombolysis in Helsinki (1998–2014; n = 2,474) to describe distributions of age, sex, stroke severity, onset-to-treatment times, and 3-month modified Rankin Scale (mRS) in routine clinical practice. We used treatment effects by time of endovascular therapy in large vessel occlusion over and above thrombolysis as reported by the Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands (MR CLEAN) study to model the shift in 3-month mRS distributions with reducing treatment delays. From the 3-month outcomes we derived patient-expected lifetimes and cumulative long-term disability with incremental treatment delay reductions.

Results: Each minute saved in onset-to-treatment time granted on average 4.2 days of extra healthy life, with a 95% prediction interval 2.3–5.4. Women gained slightly more than men due to their longer life expectancies. Patients younger than 55 years with severe strokes of NIH Stroke Scale score above 10 gained more than a week per each minute saved. In the whole cohort, every 20 minutes decrease in treatment delays led to a gain of average equivalent of 3 months of disability-free life.

Conclusions: Small reductions in endovascular delays lead to marked health benefits over patients’ lifetimes. Services need to be optimized to reduce delays to endovascular therapy.

GLOSSARY

- DALY: disability-adjusted life-years
- ICA: internal carotid artery
- MR CLEAN: Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands
- mRS: modified Rankin Scale
- NIHSS: NIH Stroke Scale
- OR: odds ratio
- tPA: tissue plasminogen activator

With multiple positive trials published in rapid succession, endovascular therapy for acute ischemic stroke is the new gold standard for large artery occlusion. The treatment effect of endovascular therapy, expressed as odds of achieving a better 3-month functional outcome compared to IV thrombolysis alone, is equally good irrespective of patients’ age and stroke severity. Just as with thrombolysis with IV tissue plasminogen activator (tPA), endovascular therapy is highly time-critical. Streamlining of acute stroke management to hasten IV thrombolysis has been an implementation success globally. Quantification of the potential patient benefits from rapidly administered endovascular therapy could also promote practice change with the new model of acute stroke care. The aim of the present study is to quantify the patient lifetime benefits gained from reduced delays in endovascular treatment.

METHODS

Overview of the model. To estimate the effect of endovascular treatment time on patient lifetime outcomes, we constructed a model based on an observational cohort of consecutive tPA patients, published pooled analysis of tPA randomized controlled trials, the benefit of endovascular therapy over tPA alone by time, general population survival data, and previously reported disability...
Disability prevention and socioeconomic savings

EXTEND-IA survival/cost benefit analysis

• ECR vs tPA alone
  – Reduces length of stay
    • 5 vs 8 days (p=0.04)
  – Rehab days
    • 0 vs 27 days (p=0.03)
  – $4775 USD cost reduction per patient at 3 months

(B Campbell et al – submitted)
Response to ECR depends on 'salvageable brain tissue'.
Endovascular clot retrieval
Christchurch Hospital
2017 ECR cases

- 60 year old woman.
- Left MCA infarction 2/3/17 – resolved. AF, due to start dabigatran
- 9/3/17 – 8am onset right hemiplegia and aphasia, left gaze preference
- NIHSS 20, initial CT scan at 9:43
Progress

- Post clot retrieval NIHSS 4
- Discharged 10/3/17, essentially full recovery

2 November 2017
2017 ECR case

4/10/2017

- 75 yr old collapsed with left hemiplegia, neglect at 6:00 am. NIHSS = 14
2017 ECR case

75 yr old collapsed with left hemiplegia, neglect at 6:00 am. NIHSS = 14

2 November 2017
Successful clot retrieval. Minor left visual field defect. Cleared for discharge 6/10/2017
Clot retrieval in the ‘extended’ time window

Current guidelines support ECR within 6 hours of onset time… however

Two trials for ECR in the ‘extended’ time window were halted early due to overwhelming efficacy for ECR over medical treatment

- DAWN
- DEFUSE 3
DAWN trial

• patients 6-24hr after last known well

• intracranial ICA or M1 occlusion

• “clinical-core mismatch”
  – age <80 & NIHSS ≥20 up to 50mL core
  – age <80 & NIHSS 10-19 up to 30mL core
  – age >80 & NIHSS >10 up to 20mL core
Co-primary endpoint

<table>
<thead>
<tr>
<th></th>
<th>Trevo</th>
<th>MM</th>
<th>Treatment benefit (95% CI)</th>
<th>Bayesian probability of superiority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 90 weighted mRS</td>
<td>5.5 ± 3.8</td>
<td>3.4 ± 3.1</td>
<td>2.1 (1.20, 3.12)</td>
<td>&gt;0.9999*</td>
</tr>
<tr>
<td>Day 90 mRS (0-2)</td>
<td>48.6%</td>
<td>13.1%</td>
<td>35.5% (23.9%, 47.0%)</td>
<td>&gt;0.9999*</td>
</tr>
</tbody>
</table>

NNT for 90-day functional independence = 2.8

*Similar to p<0.0001

2 November 2017

Jovin, Nogueira ESOC 2017
DAWN trial

mRS at 90 days

Endovascular (n=107)

Control (n=99)

ordinal NNT 2.0

2 November 2017

Jovin, Nogueira ESOC 2017
DAWN trial
DEFUSE - 3

• n=182 when stopped
• 6-16 hr
• Similar criteria to DAWN trial

https://clinicaltrials.gov/ct2/show/NCT02586415
Extended time window

- In CDHB, wake up stroke patients with intracranial occlusion and clinical deficit will be considered for ECR
- Patient independent
- Green is go!
- (Interventionalist availability)
2017 ECR cases – wake up stroke

• 85 year old man, double valve replacement (MVR/AVR) on warfarin
• Recent difficult INR control – INR 1.4
• Lives alone, went to sleep 11pm, did not answer friend’s text in the morning
• Found 10am with left hemiparesis, neglect. Code stroke
Progress

- Post clot retrieval mild dysarthria
- Discharged 5 days later when INR therapeutic, full recovery
Endovascular clot retrieval
Summary

• Most effective ‘clot busting’ strategy in large vessel occlusion
• Saves brain
• Saves lives
• Saves money
• Faster the better – *Time is Brain*
Endovascular clot retrieval
Christchurch Hospital

• First case 2014 – 49 year old man
• 2015 – 2 cases
• 2016 – 2 cases
• 2017 – 24 cases
Endovascular clot retrieval
Christchurch Hospital

• 3 ECR capable interventionalists
• Limited day time access until mid-2017
• Q3/4 2017 - ~80-90% after hours coverage
• Does not yet offer ECR to patients outside of CDHB catchment area
  – planning underway for a sustainable infrastructure
The past is a foreign country; they do things differently there.

(L. P. Hartley)
Endovascular clot retrieval
Changing landscape of stroke management

2 November 2017