Percutaneous Vascular Interventions for Acute Ischemic Stroke

Killian O’Rourke, MD; Eivind Berge, PhD; Cathal Walsh, PhD; Peter J. Kelly, FRCPI

Objectives
This is a systematic review of randomized controlled trials comparing percutaneous vascular interventions plus medical treatment to medical treatment alone for acute ischemic stroke.

Types of Percutaneous Vascular Interventions
All percutaneous arterial endovascular techniques aimed at revascularization in acute ischemic stroke, including but were not confined to: AngioJet aspiration; laser recanalization; thromboaspiration (retrieval devices); angioplasty; mechanical fragmentation of the thrombus; implantation of stents; intra-arterial thrombolysis; and intra-arterial sonothrombolysis.

All types of medical treatment could be given in addition to the percutaneous interventions.

Type of Comparison Therapy
The comparison therapy was routine medical treatment. Intravenous thrombolytic treatment was permissible only when the same intravenous thrombolytic treatment was also given to the intervention group.

Search Strategy
We searched the Trials Registers of the Cochrane Stroke Group and 8 additional databases. We also contacted researchers and equipment manufacturers and hand-searched conference proceedings. Both published and unpublished data were included. The date of most recent search was May 2010.

Data Collection and Analysis
Two reviewers independently selected studies for inclusion, assessed trial quality, and extracted the data.

Main Results
We included 4 trials involving 350 patients. Not all trials contributed data to each outcome. All trials tested intra-arterial thrombolytic drugs (urokinase or recombinant prourokinase), and only 1 trial used guidewire-mediated clot disruption in some patients randomized to the intervention group. Most data come from trials of middle cerebral artery infarction in which treatment was started up to 6 hours after stroke; 1 small trial of posterior circulation infarction tested treatment given up to a median 12.5 hours after stroke. Compared with standard medical treatment, intervention administered up to 6 hours after ischemic stroke significantly increased the proportion of patients with a favorable outcome (modified Rankin Scale score 0 to 2) at 3 months after stroke (relative risk, 1.47; 95% CI, 1.07 to 2.02). Intervention also yielded significant benefit at three months when measured as modified Rankin scale score 0–1 (Figure). Intervention also significantly increased the risk of National Institute of Neurological Disorders and Stroke-defined symptomatic intracranial hemorrhage within 24 hours of treatment (relative risk, 3.85; 95% CI, 0.91 to 16.36, respectively) but not death 3 months after stroke (relative risk, 0.89; 95% CI, 0.60 to 1.33). Intervention was strongly associated with partial or complete angiographic recanalization (Thrombolysis In Myocardial Ischemia [TIMI] Grade 2 and 3) at 120 minutes (relative risk, 4.02; 95% CI, 2.32 to 6.95). Good neurological outcome (National Institutes of Health Stroke Scale 0 to 1) 3 months after stroke was also significantly improved (relative risk, 2.03; 95% CI, 1.21 to 3.40). There was no significant heterogeneity between the included trials.

Authors’ Conclusions
Overall, intervention results in a significant increase in the proportion of patients with a favorable outcome despite a significant increase in intracranial hemorrhage. Further trials are needed to confirm or refute these findings and, given the cost and practical difficulties, to establish whether percutaneous techniques are feasible and cost-effective in wider clinical practice.
### Implications for Practice and Research

Current data are insufficient to establish the role of percutaneous vascular intervention for acute ischemic stroke in clinical practice. Data from forthcoming randomized trials will be required to confirm these findings and to establish: (1) the effects of various forms of percutaneous vascular intervention (different thrombolytic drugs, different mechanical devices); (2) the optimal time window for the use of percutaneous vascular intervention; and (3) the differential responsiveness of patient subgroups to percutaneous vascular intervention.

Trials comparing percutaneous vascular interventions with intravenous thrombolytic treatment are also required.

This article is based on a Cochrane Review published in The Cochrane Library 2010, Issue 10 (see www.thecochranelibrary.com for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and The Cochrane Library should be consulted for the most recent version of the review.

### Sources of Funding

Supported by the Health Research Board of Ireland.

### Disclosures

None.

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**Table**: Meta-analysis of 4 randomized controlled trials with associated forest plot for functional outcome defined as modified Rankin Scale score 0 to 1 at 3 months after intra-arterial thrombolysis (reproduced with permission from John Wiley & Sons, Ltd).

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental n/N</th>
<th>Control n/N</th>
<th>Risk Ratio M-H</th>
<th>Fixed 95% CI</th>
<th>Weight</th>
<th>Risk Ratio M-H</th>
<th>Fixed 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUST 2005</td>
<td>3/8</td>
<td>0/8</td>
<td></td>
<td></td>
<td>1.6%</td>
<td>7.00 [0.42, 116.91]</td>
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<tr>
<td>MELT 2007</td>
<td>24/57</td>
<td>13/57</td>
<td></td>
<td></td>
<td>42.1%</td>
<td>1.85 [1.05, 3.25]</td>
<td></td>
</tr>
<tr>
<td>PROACT 1 1998</td>
<td>8/26</td>
<td>3/14</td>
<td></td>
<td></td>
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<td>1.44 [0.45, 4.57]</td>
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</tr>
<tr>
<td>PROACT 2 1999</td>
<td>31/121</td>
<td>10/59</td>
<td></td>
<td></td>
<td>43.6%</td>
<td>1.51 [0.80, 2.87]</td>
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</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>212</strong></td>
<td><strong>138</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>1.73 [1.17, 2.57]</strong></td>
<td></td>
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</tr>
</tbody>
</table>

Total events: 66 (Experimental), 26 (Control).

Heterogeneity: Chi² = 1.27, df = 3 (P = 0.74); I² = 0.0%

Test for overall effect: Z = 2.73 (P = 0.0063)

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**Figure**: Meta-analysis of 4 randomized controlled trials with associated forest plot for functional outcome defined as modified Rankin Scale score 0 to 1 at 3 months after intra-arterial thrombolysis (reproduced with permission from John Wiley & Sons, Ltd).

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**Keywords**: outcome; percutaneous vascular interventions; recanalization; stroke; thrombolysis
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