Neurothrombectomy devices for the treatment of acute ischemic stroke: state of the evidence

CRD summary
The authors concluded that neurothrombectomy devices were interesting treatment options for patients with acute ischemic stroke, but there was a lack of high-quality research, especially on their comparative effectiveness. Despite potential bias in the selection of studies, the authors’ conclusion reflects the evidence presented and is likely to be reliable.

Authors’ objectives
To evaluate the benefits and harms of neurothrombectomy devices in the treatment of patients with acute ischemic stroke.

Searching
MEDLINE, Scopus, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews, and Web of Science were searched, with no language restriction, from inception to November 2010. Search terms were reported. Reference lists from reviews or retrieved studies were scanned for further articles. Google Scholar was searched for grey literature. Manufacturers were contacted.

Study selection
Any study, published in English, that focused on neurothrombectomy for patients with acute ischemic stroke and reported at least one clinical effectiveness outcome or harm, was eligible for inclusion in the review.

Most of the included studies evaluated the Merci Retriever device; others assessed the Penumbra System or other off-label devices. The patients were generally aged over 18 years, with baseline National Institutes of Health Stroke Scale (NIHSS) scores of eight or more. They presented within eight hours of the onset of stroke symptoms (up to 24 hours for studies of off-label devices, where posterior circulation occlusion was present) and had complete or near-complete occlusion of a treatable large intracranial vessel. Some patients had contraindications to standard intravenous thrombolytic therapy. The effectiveness outcomes included: recanalisation success, measured by the Thrombolysis in Myocardial Infarction (TIMI) flow grade or a similar method; mortality; the modified Rankin Scale score; the NIHSS score; the Barthel Index; and the Glasgow Outcome Scale score. Safety outcomes were: failure to deploy the device or remove the clot; breakage or fracture of the device; perforation; dissection; thrombus formation proximal, adjacent, or distal to the clot site; vasospasm; and haemorrhage.

Two reviewers independently selected studies for inclusion.

Assessment of study quality
Prospective single-group and retrospective studies enrolling consecutive patients were assessed for blinding of outcomes.

Two reviewers independently assessed the quality and disagreements were resolved by a third reviewer.

Data extraction
The data were extracted on the proportions of patients showing each outcome.

Two reviewers independently extracted the data and disagreements were resolved by a third reviewer.

Methods of synthesis
A narrative synthesis was presented. The devices were grouped into five broad types and the available data were tabulated by type of device. Areas indicating most of the evidence were highlighted in the tables.
Results of the review
Eighty-seven studies were included (n=1,308 patients). There were 18 prospective single-group studies, seven non-comparative retrospective studies enrolling consecutive patients, and 62 case series or reports. A quarter of the studies were available only as abstracts. Three of the 18 prospective and one of the seven retrospective studies reported blinding for outcome assessment.

In the 25 prospective or retrospective studies, successful recanalisation ranged from 43% to 78% in 10 studies with the Merci Retriever; from 83% to 100% in seven studies with the Penumbra System; and from 50% to 90% in eight studies with the off-label devices. The percentage of patients achieving a good outcome (zero to two on the Rankin Scale) and mortality were reported in 17 of the 25 studies. Mortality ranged from 29% to 44% with the Merci Retriever (five studies); from 11% to 45% with the Penumbra System (seven studies); and from zero to 38% with the off-label devices (five studies).

The most frequently reported harms were symptomatic and asymptomatic intracranial haemorrhage. The incidence rates ranged from zero to 10% (symptomatic) and 28% to 43% (asymptomatic) with the Merci Retriever (five studies); zero to 11% (symptomatic; seven studies) and 1% to 30% (asymptomatic; five studies) with the Penumbra System; and from 6% to 25% (symptomatic; five studies) and 6% to 17% (asymptomatic; three studies) with the off-label devices. The reported target vessel perforation or dissection was zero in nine studies, and 5% and 7% in two studies.

Authors' conclusions
The neurothrombectomy devices were interesting treatment options for patients with acute ischaemic stroke, but there was a lack of high-quality research, especially for their comparative effectiveness.

CRD commentary
The review question was clear and it was supported by broad inclusion criteria, which resulted in substantial clinical heterogeneity in the selected studies. The search strategy was wide-ranging, and included attempts to minimise publication and language biases, but the selection of published English-language studies might mean that relevant studies were missed. The designs of the included studies limited the potential for a thorough quality assessment, but some assessment was performed and this suggested poor quality in the included non-comparative studies. The review process was carried out with sufficient transparency, the details were provided for the prospective, single-arm, and retrospective studies, and the chosen method of synthesis was appropriate.

Despite potential bias in the selection of studies, the authors' conclusion reflects the evidence presented and is likely to be reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that future adequately-powered randomised controlled trials should evaluate the comparative effectiveness of neurothrombectomy devices. These trials should identify the patients most likely to benefit and their level of occlusion and explore the health outcomes beyond recanalisation. The authors provided a summary of ongoing studies, including several randomised controlled trials, that will strengthen the future evidence base.

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Bibliographic details
Other publications of related interest


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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.