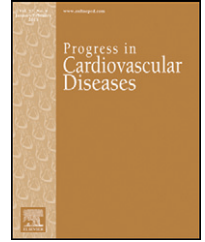




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# Endovascular Therapy for Acute Stroke



Maria Politi<sup>a</sup>, Andreas Kastrup<sup>b</sup>, Konstantinos Marmagkiolis<sup>c,d</sup>, Iris Q. Grunwald<sup>e</sup>,  
Panagiotis Papanagiotou<sup>a,e,\*</sup>

<sup>a</sup>Clinic for Diagnostic and Interventional Neuroradiology, Hospital Bremen-Mitte

<sup>b</sup>Clinic for Neurology, Hospital Bremen-Mitte

<sup>c</sup>Pepin Heart Institute Florida Hospital, Tampa, FL

<sup>d</sup>University of Missouri, Columbia, MO

<sup>e</sup>Neuroscience and Vascular Simulation Unit, Anglia Ruskin University, Essex, UK

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## ABSTRACT

Stroke is the most common cause of permanent disability, the second most common cause of dementia, and the fourth most common cause of death in the Western world. Recently, based on positive multicenter randomized clinical trials, endovascular therapy for acute stroke has undergone a revolution. Routine mechanical thrombectomy in addition to intravenous thrombolysis has been shown to provide excellent outcomes for patients with proximal anterior circulation occlusions. This procedure reduces disability and benefits are seen across a wide range of age and initial stroke severity. Important features that affect treatment decisions include time of presentation, the patient's clinical status, imaging characteristics, and lab tests. Under optimal conditions, it should be available to patients 24/7, similar to systems offering prompt percutaneous coronary interventions to patients with acute ST-segment elevation myocardial infarctions.

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Statement of Conflict of Interest: see page 540.

\* Address reprint requests to Panagiotis Papanagiotou, Clinic for Diagnostic and Interventional Neuroradiology, Hospital Bremen-Mitte, Germany, St.-Jürgen Str. 1, 28177.

E-mail address: [papanagiotou@me.com](mailto:papanagiotou@me.com) (P. Papanagiotou).

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### Abbreviations and Acronyms

**ASPECTS** = Alberta Stroke Program Early CT Score  
**CTA** = CT angiography  
**CT** = computed tomographic  
**EVT** = endovascular therapy  
**IAT** = intra-arterial thrombolysis  
**IV** = intravenous  
**MCA** = middle cerebral artery  
**mRS** = modified Ranking Scale  
**NIHSS** = National Institutes of Health Stroke Scale  
**PTT** = partial thromboplastin time  
**t-PA** = recombinant tissue plasminogen activator  
**tICA** = terminal internal carotid artery  
**TICI** = Thrombolysis In Cerebral Infarction

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### Introduction

Stroke is the most common cause of permanent disability, the second most common cause of dementia, and the fourth most common cause of death in the Western world.<sup>1</sup> The World Health Organization estimates that 5.7 million people die from stroke each year. Each year about 795,000

Recently, based on positive multicenter randomized clinical trials, endovascular therapy (EVT) underwent a revolution.<sup>7</sup> Endovascular treatments increase the chance of successful and rapid recanalization. In recent years, much effort has been made to develop new revascularization devices that provide faster and higher recanalization rates in order to generate a better clinical outcome for patients.<sup>8</sup> Several randomized clinical trials have assessed this combined approach. Between December 2014 and August 2016, six randomized, controlled trials and individual patient data meta-analysis demonstrated that thrombectomy combined with standard medical treatment is more effective than standard medical treatment alone for severe acute stroke caused by large-vessel occlusion in anterior circulation.<sup>7,9–14</sup> International guidelines have been recently updated to include recommendation of EVT when possible.<sup>15</sup>

people in the United States and 1 million people in the European Union experience a new or recurrent stroke (ischemic or hemorrhagic). The majority (>80%) of acute strokes are ischemic. The patients who survive are often burdened with exorbitant rehabilitation costs, lost wages and productivity, limitations in their daily social activity, and significant residual disability.<sup>2</sup> Given that the aging population of the world is increasing in size, the statistics of stroke incidence and prevalence are likely to also climb proportionately.

The drug therapy for acute ischemic stroke is thrombolysis with recombinant tissue plasminogen activator (t-PA), which has been shown in clinical trials to be effective.<sup>3</sup> However, among occlusions of large proximal vessels resulting in severe strokes, recanalization rates are reduced, resulting in an overall poor prognosis. For many years the concept of catheter directed delivery of thrombolytic medications was investigated. The hypothesis behind this treatment paradigm was that delivering thrombolytics directly to the site of arterial occlusion may provide faster vessel recanalization with fewer bleeding complications due to less thrombolytic drug use. The goal of intra-arterial thrombolysis (IAT) was to decrease the level of disability caused by the stroke and perhaps increase the thrombolytic window beyond the 3 h studied in the original NINDS trial with IV tPA.<sup>4</sup> The Prolyse in Acute Cerebral Thromboembolism II (PROACT II) randomized controlled study provided pilot data supporting this hypothesis.<sup>5</sup> However a recent meta-analysis comparing IAT to supportive medical therapy as well as to intravenous (IV) tPA failed to demonstrate compelling benefit.<sup>6</sup>

### Background and evidence

#### Recent randomized clinical trials

Recently, the Multicenter Randomized Clinical Trial of Endovascular Treatment of Acute Ischemic Stroke in the Netherlands (MR CLEAN) demonstrated a clear overall benefit of adding EVT to standard care (including intravenous thrombolysis) in patients with acute ischemic stroke caused by proximal arterial occlusion of the anterior circulation, if administered within 6 h from symptom onset.<sup>7</sup>

After publication of the results of MR CLEAN five subsequent trials – ESCAPE (Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion With Emphasis on Minimizing CT to Recanalization Times),<sup>13</sup> EXTEND-IA (Extending the Time for Thrombolysis in Emergency Neurological Deficits - Intra-Arterial),<sup>11</sup> SWIFT PRIME (Solitaire With the Intention for Thrombectomy as Primary Endovascular Treatment),<sup>12</sup> REVASCAT (Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours After Symptom Onset in Ischemic Stroke),<sup>10</sup> and THRACE (Mechanical thrombectomy after intravenous alteplase versus alteplase alone after stroke)<sup>14</sup> – demonstrated the efficacy of EVT versus IV-tPA alone in treating patients with acute anterior circulation ischemic stroke.

All six randomized, controlled trials, showed a benefit for EVT compared with IV t-PA alone regarding functional

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