Endovascular embolectomy for acute ischaemic stroke: an update

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Don't miss it!
Josef Roesch Lecture
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Auditorium 1

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Prof. Antonin Krajina is an IR at the University Hospital of Hradec Králové in the Czech Republic, where he received his medical degree. He completed his IR fellowship at the Oregon Health Sciences University, in Portland under Prof. Josef Rösch, Prof. Frederick S. Keller, and Dr. Stanley Barnwell. His research and clinical career have encompassed many vascular procedures and devices, particularly portosystemic shunts, balloon and stent angioplasty, AAA stent grafts, intra-arterial infusions and neurointerventions. Prof. Krajina has held CIRSE Fellowship since 1999, and has served as a member of the editorial board as well as a reviewer for CVIR, JVIR, European Journal of Radiology and others. Previously, he was also a member of the CIRSE Stroke Therapy Task Force.

Stroke is the leading cause of disability, and due to intensive care, it has dropped to the fourth leading cause of death in 2008. This was the result of improved cardiovascular risk prevention, better care during the first few hours of acute stroke, and also public awareness of the possibility to be treated successfully in the acute stage.

The history of stroke therapy goes back to the 1950s. The first reported recanalisation after intravenous plasmin infusion and angiographically documented intracranial recanalisation was published by Sussman et al. in 1958 [1]. Endovascular therapy of acute ischaemic stroke with an intra-arterial infusion of thrombolytics was started by a pioneer of this therapy, Hermann Zeumer, in 1978. His strategy of invasive stroke therapy was based on an existing therapeutic window due to delayed deterioration of patients with acute stroke [2]. Twenty years later, the first randomised study comparing results of local intra-arterial fibrinolytic infusion with placebo was published [3]. This study revealed 9% benefit in patients with modified Rankin scale (mRS) 0–1 when local fibrinolytics were infused as close to the clot as possible over placebo. However, later experience showed that embolus volume limits the efficacy of thrombolytic therapy even if it is administered locally with a high concentration of fibrinolytics.

Intra-arterial mechanical clot disruption using microcatheters and wires in combination with intra-arterial thrombolysis was described by Stanley Barnwell and colleagues in 1994 [4].

The turning point came with a case report by Chopko et al. [5] demonstrating successful clot removal using an intra-arterial snare; this probably initiated development of dedicated devices for intra-arterial blood clot extraction. The first such system was introduced in 2004 (Mechanical Embolus Removal in Cerebral Ischemia – MERCI) [6] and, simultaneously, the Penumbra system [7]. The principle of the first was based on mechanical atraumatic removal of the clot while the blood flow was stopped; the second one was based on aspiration of the disrupted clot.

Both these systems were replaced with a stent retriever, whose construction was based on retrievable, detachable intracranial stents [8]. The design of the self-expandable intracranial stent enabled deployment of this stent into the clot, which was then entrapped by it. The non-detached stent was slowly removed under aspiration through the guiding balloon-tipped catheter previously developed for the MERCI retriever.

When this device, together with improved logistics of patients, was evaluated by randomised studies, the benefit over intravenous thrombolysis was definitively proved in 2015 [9]. There have been several studies proving significant superiority of mechanical thrombectomy over intravenous thrombolysis in occlusion of the internal carotid artery and M1, while benefit to the other distal and posterior territories has not yet been proved by randomised studies. The extent of benefit in these studies was dependent on the selection criteria for inclusion of patients.

The attention of investigators has turned to patients coming more than 6 hours after onset of symptoms. Here, it has been seen that individual collateral flow keeps the therapeutic window open beyond 6 hours based on imaging criteria. Two recently published trials showed that in patients who are selected using CT perfusion or diffusion-weighted imaging, thrombectomy significantly improves outcomes, even up to 24 hours from onset. Whether patients showing large infarction on CT (ASPECTS 3-5) can be helped by recanalisation will be evaluated in the near future too.

The AHA/ASA's 2018 Guidelines for the Early Management of Patients with Acute Ischemic Stroke [10] recommended patient transfer to comprehensive stroke centres where thrombectomy can be performed. These centres should provide parenchymal CT imaging and CT arteriography (CTA). These two modalities provide sufficient information to determine eligibility for endovascular treatment in the first 6 hours from stroke onset. CTA should be performed without waiting for a serum creatinine level [10]. Physicians performing endovascular therapy of stroke must be properly trained in clinical neuroscience, neuroimaging and neurointerventions [11].

Successful endovascular stroke therapy reduces the number of patients who will be dependent on care, or live in nursing homes. This will lead to significant cost savings in social care budgets across Europe, rendering the treatment highly cost-effective [12]. The success rate of this therapy depends on its organisation, which includes the rapid transport of patients, fast clinical and diagnostic evaluation, quick decisions and the availability of a trained interventional team.

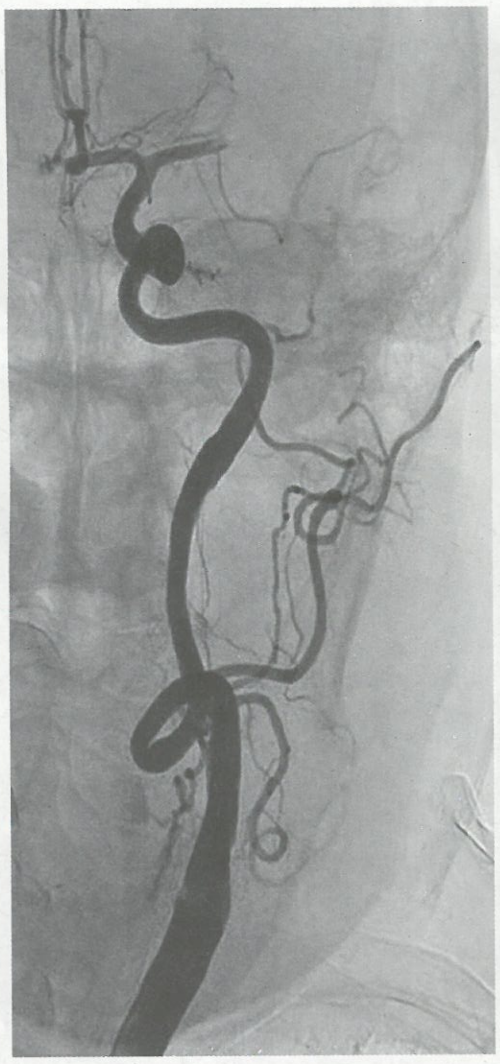

Fig. 1: Embolic occlusion of M1 segment of the left middle cerebral artery.

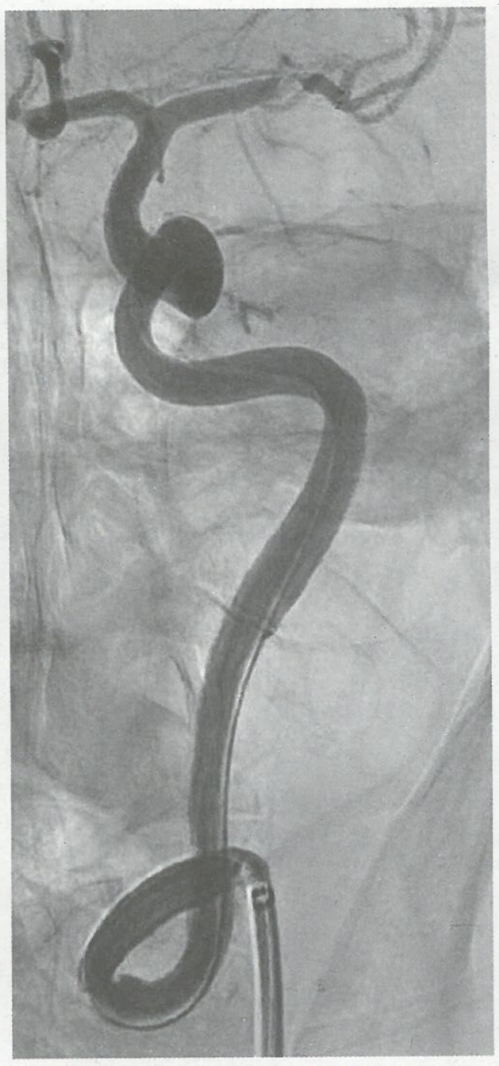

Fig. 2: The internal carotid artery was catheterised with a microcatheter and a non-detached stent was deployed across the occluded segment of the middle cerebral artery. Partial flow was already seen on this angiogram.

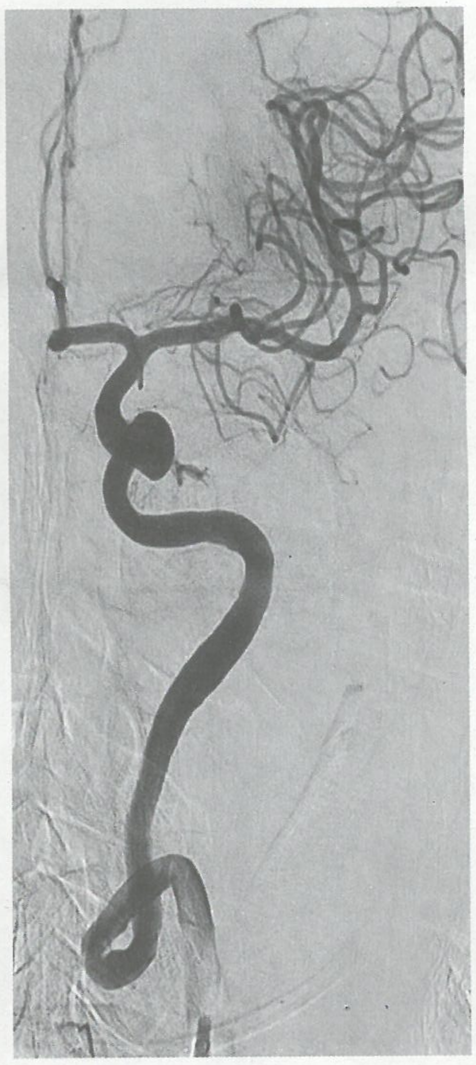

Fig. 3: Completion angiogram revealed full recanalisation of the middle cerebral artery. The patient´s right-sided hemiparesis and aphasia recovered a day later.

Fig. 4: The stent-retriever after removal with clot entrapped among its struts.

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