

Interventional Mechanical thrombectomy Indications and limitations A Mini-Review

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Abstract:

The endovascular clot retrieval in combination with intravenous recombinant tissue plasminogen activator (rtPA) has been established as the 1st choice therapy for the treatment of acute arterial ischemic stroke (AIS) in case of large vessel occlusion. While the results of this therapy in ischemic insults in the anterior stromal region are clearly positive, the results for mechanical thrombectomy in posterior circulation are controversially discussed. In addition, the indication is made by the time window, sizing of the ischemic area, and various scores. The aim of the article is to review the available reports on the use of thromboelastography in acute ischemic stroke patients.

Keywords: endovascular clot retrieval; lyse therapy; salvageable penumbral tissue; anterior circulation

Introduction

After publication of the 5 HERMES (Highly Effective Reperfusion Evaluated in Multiple Endovascular Stroke) studies, endovascular clot retrieval in combination with intravenous recombinant tissue plasminogen activator (rtPA), if possible, has become the therapy of choice in treatment of acute arterial ischemic stroke (AIS) in case of large vessel occlusion (LVO) of the anterior circulation, based on positive randomized controlled trials [1-11]. Very good results between 35% and 42% were achieved within 4.5 hours of therapeutic windows and with the use of modern devices [4-7].

Discussion

Strict selection criteria based on additional advanced brain imaging with greater volume of salvageable penumbral tissue inevitably lead to better end results (9-11). The efficacy of MT is undisputed with an NNT of only 3 in early stroke therapy [12]. However, the practical implementation of mechanical thrombectomy can be of great benefit in the case of dissections of the A. carotis comm. As an access route, mechanical thrombectomy may come up against its limits. In this case, a dissection of the carotid artery at the beginning of a thrombectomy makes it impossible to insert the guide wire. Several studies have found that after mechanical thrombectomy in the anterior region, patients, have an absolutely better chance of being functionally independent after 90 days by about 20% compared to the control groups, with results also being better than in patients after pure thrombolysis [13-18].

Saver et al. showed that the chance of being functionally independent after mechanical thrombectomy decreases after 90 days with every hour of

delay until the start of the procedure decreases by 3.4%, and the probability of a favourable decrease in disability with one point on the mRS scale decreases by 5.3% at 90 days [19]. Despite the very narrow therapeutic window, recent studies have demonstrated salvageable brain tissue [20-32] by multiphasic computed tomography angiography (CTA) excluding advanced brain imaging, even after 12-24 hours.

Perfusion imaging cannot be used as the sole criterion for strict selection of patients for mechanical thrombectomy.

In a detailed systematic meta-analysis of all newer RCTs, Saver et al. could demonstrate an association of perfusion mismatch neither with functional independence nor with functional improvement, so that a large estimated ischemic core in patients within 6 h of stroke onset should not be an exclusion criterion from mechanical thrombectomy [19].

In addition, a 30-minute delay in imaging time to reperfusion due to perfusion imaging corresponds to an increase in ischaemic core volume of 10 ml [11, 33-35].

In addition, CTP and/or MRI diffusion/perfusion overestimate the size of the infarct area, thus excluding a large proportion of patients eligible for mechanical thrombectomy [36-40].

NIHSS and ASPECTS are used as a reliable marker for clinical deficits and to assess early infarction [41,42]. An adequate efficacy of thrombectomy has been demonstrated in patients with NIHSS and ASPECTS ≥ 6 [43,44].

So far, visible infarction of more than one third of the territory and mRS before stroke ≥ 3 have been assumed to be exclusion criteria [45,46].

The results for mechanical thrombectomy in posterior circulation are controversially discussed. Due to hardly available usable data from posterior circulation and contradictory final results, a benefit for MT on intention-to-treat analysis for patients with posterior circulation is not assumed.

Patients with NIHSS < 6 or more extensive early infarction changes and patients with more distal occlusions also do not benefit from MT [47-49].

Ultimately, the indication for mechanical thrombectomy is given according to the type of stroke, severity, stroke in the anterior or posterior supply type, time of onset, disability before stroke, extent of ischaemia [50,51].

Ischaemic strokes in the LAO care area benefit from a small incidence of infarction with an NIHSS < 6 have not been shown to benefit from MT [52,53].

The exclusion criteria are a visible infarction over more than one third of the territory and mRS before stroke ≥ 3 [54].

The Solumbra technique, a combination of stent retriever and aspiration thrombectomy, not only achieved better primary recanalisation rates but also significantly better 3-month results [55-57].

Possible complications are listed in the literature on hemorrhagic transformation, hemorrhagic infarction, parenchymal hematoma, subarachnoid hemorrhage, symptomatic intracranial hemorrhage and procedural complications such as arterial injury are mentioned [58].

Dissection of the A. carotis comm. which led to an ischemic stroke was often described, but not a dissection of the carotid artery during catheter intervention for mechanical thrombectomy, which makes it impossible to perform MT [59,60].

In the case of an rare iatrogenic dissection of the A. carotis comm., open mechanical thrombectomy and an open retro-grad stenting of the carotid artery comm. can be a therapeutic option.

Contrary to earlier assumptions, intravenous rtPA therapy does not delay treatment times or increase the risk of intracranial hemorrhage. This combination therapy has resulted in better overall TICI scores and long-term functional outcomes compared to thrombectomy alone [61-64].

Conclusion

The therapeutic results of the endovascular clot retrieval in combination with intravenous recombinant tissue plasminogen activator (rtPA) ischemic insults in the anterior circulation are undisputed and consistently positive. Undoubtedly, the best results are obtained in a time window of 4-5 hours. Reduces the time delay until the start of therapy decrease in disability on the mR scale even later in the course. When determining the indication, it must still be considered that the CTP and/or MRI diffusion/perfusion overestimates the size of the infarct area, thus excluding a large proportion of patients eligible for mechanical thrombectomy.

Abbreviation

rtPA	:Recombinant tissue plasminogen activator
AIS	:Arterial ischemic stroke
HERMES	:Highly Effective Reperfusion Evaluated in Multiple Endovascular Stroke
NNT	:Number needed to treat
CTA	:Computed tomography angiography
RCT	:Randomized controlled trial
CTP	:Computed tomography perfusion
NIHSS	:National Institutes of Health Stroke Scale
ASPECTS	:Alberta stroke programme early CT score

MT	:Mechanical thrombectomy
mRS	:Pre-Stroke Modified Rankin Score

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