

Endovascular Procedures versus Intravenous Thrombolysis in Stroke with Tandem Occlusion of the Anterior Circulation

Serdar Tütüncü, MD, Jan F. Scheitz, MD, Georg Bohner, MD, Jochen B. Fiebach, MD, Matthias Endres, MD, and Christian H. Nolte, MD

ABSTRACT

Purpose: Stroke with tandem occlusion within the anterior circulation presents a lower probability of recanalization and good clinical outcome after intravenous (IV) thrombolysis than stroke with single occlusion. The present study describes the impact of endovascular procedures (EPs) compared with IV thrombolysis alone on recanalization and clinical outcome.

Materials and Methods: Thirty patients with symptom onset less than 4.5 hours and tandem occlusion within the anterior circulation were analyzed retrospectively. Recanalization was assessed per Thrombolysis In Cerebral Infarction (TICI) classification on computed tomography, magnetic resonance imaging, or digital subtraction angiography within 24 hours. Infarct size was detected on follow-up imaging as a dichotomized variable, ie, more than one third of the territory of the middle cerebral artery. Clinical outcomes were major neurologic improvement, independent outcome (90-d modified Rankin Scale [mRS] score), symptomatic intracerebral hemorrhage (sICH; per European Cooperative Acute Stroke Study criteria), and death within 7 days.

Results: Patients treated with EPs ($n = 14$) were significantly younger and had a history of arterial hypertension more frequently than patients treated with IV thrombolysis alone ($n = 16$). Recanalization (ie, TICI score 2b/3; EP, 64%; IV, 19%; $P = .01$), major neurologic improvement (EP, 64%; IV, 19%; $P = .01$), and independent outcome (mRS score ≤ 2 ; EP, 54% IV, 13%; $P = .02$) occurred more often in the EP group, whereas infarct sizes greater than one third of the MCA territory (EP, 43%; IV, 81%; $P = .03$) were observed less often. Rates of sICH ($P = .12$) and death within 7 days ($P = .74$) did not differ significantly.

Conclusions: Higher recanalization rate, smaller infarct volume, and better clinical outcome in the EP group should encourage researchers to include this subgroup of patients in prospective randomized trials comparing IV thrombolysis versus EP in stroke.

ABBREVIATIONS

CI = confidence interval, EP = endovascular procedure, MCA = middle cerebral artery, mRS = modified Rankin scale, NA = not applicable, NIHSS = National Institutes of Health Stroke Scale, OR = odds ratio, rt-PA = recombinant tissue plasminogen activator, sICH = symptomatic intracerebral hemorrhage, TICI = Thrombolysis In Cerebral Infarction

From the Departments of Neurology (S.T., J.F.S., M.E., C.H.N.) and Radiology (G.B.), Charité–Universitätsmedizin; and Center of Stroke Research (J.F.S., J.B.F., C.H.N.), Berlin, Germany. Received May 25, 2013; final revision received February 9, 2014; accepted February 24, 2014. **Address correspondence to S.T.**, Department of Neurology, Charité–Universitätsmedizin Berlin, Campus Benjamin Franklin, Hindenburgdamm 30, 12203 Berlin, Germany; E-mail: serdar.tuetuencue@charite.de

The study was funded by the German Federal Ministry of Education and Research via grant support to the Center for Stroke Research (Berlin, Germany). S.T. and J.F.S. received travel grants from Boehringer Ingelheim (Ingelheim, Germany). J.B.F. received honoraria from PAION (Aachen, Germany) and Lundbeck Pharma as members of the steering committee or imaging committee. C.H.N. has received speaker honoraria from Boehringer Ingelheim and Pfizer (New York, New York) and research support from the German Ministry of Research and Education. Neither of the other authors has identified a conflict of interest.

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J Vasc Interv Radiol 2014; XX:■■■–■■■

<http://dx.doi.org/10.1016/j.jvir.2014.02.027>

Among strokes treated with intravenous (IV) thrombolysis, successful recanalization and good clinical outcome occur less often in cases of tandem occlusion (occlusion of ipsilateral extra- and intracranial arteries) than in cases of single intracranial vessel occlusion (1–3). Endovascular procedures (EPs) represent a promising option in patients with large-vessel occlusions (4,5). Recently published prospective randomized trials (6–8) failed to show superiority of EP versus standard medical care with IV recombinant tissue plasminogen activator (rt-PA). However, these studies did not include patients with tandem occlusions. Data on patients with tandem occlusions have been limited to a few case reports or small case series that lacked comparison groups (9–12). Therefore, it remains unclear if EP results in a better vascular and clinical outcome in those patients. The aim of the present study is to describe the impact of rescue

approaches with EP on radiologic outcomes (intracranial vessel recanalization, infarct size) and clinical outcomes compared with treatment with IV rt-PA alone in patients with stroke with tandem occlusion.

MATERIALS AND METHODS

The local ethical committee approved standard quality-assurance measures and allowed publication of the present data.

Study Population

Thirty patients with stroke with a symptom onset less than 4.5 hours and proven tandem occlusion of the anterior circulation (eg, occlusion of the ipsilateral extracranial internal carotid artery [ICA] and additionally the intracranial carotid T or middle cerebral artery) were identified in our ongoing thrombolysis registry (13). Vessel occlusions were detected by magnetic resonance (MR) angiography or computed tomographic (CT) angiography. Patients were treated with IV rt-PA alone or with a rescue approach with EPs (IV rt-PA and/or intraarterial [IA] rt-PA and/or mechanical neurothrombectomy).

In September 2010, an intradepartmental conference defined the management of severely affected acute stroke cases: CT angiography or MR angiography was made mandatory in all patients presenting within 4.5 hours after the event, and patients with a National Institutes of Health Stroke Scale (NIHSS) score of at least 10 were

considered eligible for rt-PA. If the angiography revealed an occlusion of proximal vessels (ICA, carotid T, and/or middle cerebral artery [MCA] main stem), therapy in a rescue approach with EPs was attempted. Therefore, the present study mainly constitutes a before-and-after comparison. Vessel status was assessed by CT angiography or MR angiography performed within 24 hours after the first imaging or by the last series of digital subtraction angiograms after EPs. For each patient, sociodemographic data (age, sex, living conditions) were recorded, as were stroke risk factors (arterial hypertension, diabetes mellitus, hypercholesterolemia, smoking, previous stroke, atrial fibrillation) and other factors potentially associated with vessel recanalization or clinical outcome (onset to treatment time, site of intracranial vessel occlusion, NIHSS score on admission).

Diagnostic Tools

Parenchymal and vessel imaging was performed with a 3-T MR scanner and included MR angiography (Tim Trio; Siemens, Erlangen, Germany) or contrast-enhanced CT (64-row Sensation 16; Siemens, Erlangen, Germany) with CT angiography. Details of the MR imaging protocol were published previously (14). The TICI score was used to assess the degree and rate of recanalization (15). Clinical outcome was assessed by physicians certified in NIHSS and modified Rankin scale (mRS) scoring. The outcome after 3 months was assessed by mRS by using a standardized questionnaire or a standardized telephone interview (16).

Table 1. Baseline Characteristics

Characteristic	EP (n = 14)	IV rt-PA Alone (n = 16)	P Value
Male sex	7 (50)	7 (44)	.73
Median age (y)	62 (54–69)	81 (74–88)	<.00
Median NIHSS score	19 (15–22)	18 (14–21)	.42
Arterial hypertension	9 (64)	16 (100)	.01
Diabetes mellitus	1 (7)	2 (13)	.63
Atrial fibrillation	5 (36)	8 (50)	.43
Hyperlipidemia	6 (43)	5 (31)	.51
Smoking	6 (43)	4 (25)	.30
Previous stroke	3 (21)	2 (13)	.64
Coronary heart disease	2 (14)	3 (19)	.74
Site of MCA occlusion			
M1 (main stem)	12 (86)	10 (63)	.15
M2/M3 branch	0	3 (19)	.09
Carotid T	2 (14)	3 (19)	.74
Left-sided MCA infarction	9 (64)	7 (44)	.26
Median onset to IV rt-PA (min)	87 (74–131)	106 (86–119)	.06
Median onset to endovascular treatment (min)	204 (156–229)	–	
MR as initial imaging modality	7 (50)	13 (81)	.07
Admission from nursing home	0	2 (13)	.17

Values in parentheses are percentages or interquartile ranges as appropriate.

EP = endovascular procedure; IV = intravenous, MCA = middle cerebral artery; NIHSS = National Institutes of Health Stroke Scale; rt-PA = recombinant tissue plasminogen activator.

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