



Leukoaraiosis is a predictor of futile recanalization in acute ischemic stroke

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Introduction and Objectives: Futile recanalization (FR) occurs when successful recanalization fails to improve clinical outcome in acute ischemic stroke (AIS) patients. Predictors of FR are still debated and may help in selecting patients for reperfusion strategies. We aim to determine whether leukoaraiosis, graded on non-contrast head computed tomography (NCHCT), may be useful in predicting FR in AIS patients treated by endovascular mechanical thrombectomy (EMT).

Materials and Methods: we retrospectively evaluated all patients with AIS due to anterior circulation large vessel occlusion undergoing EMT, referring to our center between August 2012 and December 2015. We included in the analysis only patients with complete vessel recanalization and we collect for all of them: demographics, vascular risk factors, baseline NIHSS, time from symptoms onset to recanalization, Alberta Stroke Program Early CT Score (ASPECTS), and leukoaraiosis graded on a 4-point van Swieten scale on NCHCT. We dichotomized patients into those with moderate-severe leukoaraiosis (2-4) versus those with absent-slight leukoaraiosis (0, 1). Outcome measures were symptomatic intracranial hemorrhage (sICH), and modified Rankin scale score at 90 days. The relationships among radiological parameters and clinical data with outcome measures were studied with univariate and multivariate analysis.

Results: sixty-eight patients were identified. Median time from symptoms onset to recanalization were 245.1 minutes. Recanalization was futile in 32.4% of cases. Demographics, clinical and radiological characteristics, treatments and outcomes in the study cohort are given in table 1. Differences in clinical and radiological characteristics between patients with good vs. poor outcomes are summarized in Table 2. In logistic regression analysis, FR was positively associated with the presence of moderate-severe leukoaraiosis ($P<0.01$). Furthermore also higher NIHSS score at baseline ($P<0.01$) and EMT alone treatment ($P=0.04$) resulted independent predictors of FR.

Conclusions: we hypothesized that leukoaraiosis may be a predictor of FR. Our results confirmed this hypothesis, showing that the presence of moderate-severe leukoaraiosis is associated with poor outcome in recanalized patients. presence of moderate-severe leukoaraiosis may predict FR and may be considered in the decision-making on revascularization strategies for AIS patients.

Table 1. Demographics, clinical and radiological characteristics, treatments and outcomes in the study cohort

Characteristics	
Age; median (IQR), y	74 (66-79)
Gender; n F (%)	34 (50.0)
Risk Factors	
Hypertension, n (%)	49 (72.1)
Diabetes mellitus, n (%)	10 (14.7)
Atrial Fibrillation, n (%)	36 (52.9)
Hyperlipidemia, n (%)	23 (33.8)
Cause of stroke	
Large artery disease, n (%)	20 (29.4)
Small artery disease, n (%)	0 (0)
PCSE, n (%)	38 (55.9)
Other, n (%)*	4 (5.9)
Unknown, n (%)	6 (8.8)
Trattamento	
EMT alone, n (%)	35 (51.5)
COT, n (%)	33 (48.5)
Clinical and neuroradiological characteristics	
Baseline NIHSS; median (IQR)	17 (14-21)
Onset to recanalization time; mean ± SD, min	245.1 ± 71.4
ASPECTS score; median (IQR)	9 (8-10)
Moderate-severe LA; n (%)	23 (33.8)
Outcomes	
sICH, n (%)	4 (5.9)
Independency (mRS 0-2) at 3 months; n (%)	46 (67.6)
Site of occlusion	
tICA, n (%)	9 (13.2)
MCA-M1 segment, n (%)	46 (67.6)
MCA-M2 segment, n (%)	13 (19.1)

Table 2. Comparison of clinical and radiological data between futile and useful recanalization groups

Characteristics	Useful (mRS 0-2) N = 46	Futile (mRS 3-6) N = 22	P value Univariate	P value Multivariate
Age; median (IQR), y	74 (66-79)	75 (69-80)	0.69 ¹	
Gender; n F (%)	25 (54.3)	9 (40.1)	0.44 ²	
Hypertension, n (%)	33 (71.7)	16 (72.7)	0.93 ²	
Diabetes mellitus, n (%)	4 (8.7)	6 (27.3)	0.05 ²	
Atrial Fibrillation, n (%)	24 (52.2)	12 (54.5)	0.85 ²	
Hyperlipidemia, n (%)	16 (34.8)	7 (31.8)	0.81 ²	
SBP, mean ± SD, mmHg	146 ± 20.1	147.1 ± 19.3	0.95 ¹	
DBP, mean ± SD, mmHg	78.9 ± 14.9	78.1 ± 10.8	0.87 ¹	
tICA, n (%)	4 (8.7)	5 (22.7)	0.11 ²	
MCA-M1 segment, n (%)	31 (67.4)	15 (68.2)	0.94 ²	
MCA-M2 segment, n (%)	11 (23.9)	2 (9.1)	0.14 ²	
COT, n (%)	27 (58.7)	6 (27.3)	0.02 ²	0.04 ³
Baseline NIHSS; median (IQR)	15 (11-19)	19 (18-22)	<0.01 ¹	<0.01 ³
Onset to recanalization time; mean ± SD, min	239.8 ± 71.2	257.9 ± 72.3	0.36 ¹	
ASPECTS score; median (IQR)	9 (8-10)	9 (8-10)	0.30 ¹	
Moderate-severe LA; n (%)	11 (23.9)	12 (54.5)	0.01 ²	<0.01 ³
sICH; n (%)	0 (0)	4 (18.2)	<0.01 ¹	0.92 ³

¹ Mann-Whitney test for unpaired groups

² Fisher's exact test

³ Forward stepwise logistic regression

mRS: modified Rankin Scale; IQR: inter-quartile range; F: female; SBP: systolic blood pressure; DBP: diastolic blood pressure; SD: standard deviation; tICA: terminal internal carotid artery; MCA: medial cerebral artery; COT: combined treatment; NIHSS: National Institutes of Health Stroke Scale; ASPECTS: Alberta Stroke Program Early CT Score; LA: leukoaraiosis; sICH: symptomatic intracerebral hemorrhage.

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