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Original Article

Diffusion weighted imaging and time in acute ischemic stroke, is there any relation?

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ABSTRACT

Background and purpose. – Diffusion-weighted MRI (DWI) is useful for patient selection during the first 6 hours after stroke onset. The main aim of this study was to investigate the relationship between the time from stroke symptom onset and stroke volume assessed using DWI.
Materials and methods. – We evaluated 203 patients with anterior circulation stroke who were admitted to Montpellier's Stroke Unit and for whom a DWI ASPECT score (DWI-ASPECTS) was obtained during the first 6 hours from symptom onset. Patients were classified according to the number of hours after the onset of symptoms that DWI was performed. Two experienced neuroradiologists independently calculated the DWI-ASPECTS, which was classified by the size of the stroke volume in three groups: 0–3, 4–6 and 7–10.
Results. – No relationship was found between temporal groups and the DWI-ASPECTS. The number of patients who reached each of the 3 classified stroke volumes was not different between the temporal groups.
Conclusion. – There is no correlation in our findings between the time of stroke symptom onset and the DWI-ASPECT score during the first 6 hours from stroke onset.

Introduction

Urgent reperfusion of the ischemic brain is the principal aim of stroke treatment [1]. Treatment selection is based on clinical and imaging evaluation [2]. Recently endovascular stroke therapy has been proposed as a priority option in acute ischemic stroke [3–5]. According to the latest international guidelines, the selection of patients for revascularization therapy should be based on the presence of a thrombus and the potential to intervene within six hours of stroke onset. Nevertheless, the stroke volume at presentation, which seems to be a major determinant of the outcome in patients receiving endovascular therapy [6], is influenced not only by time but also by the status of the collateral arteries [6,7]. Collaterals arteries have an important role in maintaining brain perfusion in acute ischemic stroke, thereby influencing the time window for treatment and prognosis [5,8]. In clinical practice we have observed patients who show a rapid increase in stroke volume in the initial hours following stroke onset—a "fast expander" profile—and also "slow expander" patients—those with a small stroke volume in the initial hours of symptom onset [9,10]. Thus, the option of revascularization therapy should depend not only on the 6-hour time window, but also on imaging findings showing the infarct volume and the perfusion status of the brain [11]. The goal of our study was to assess at different time points the diffusion-weighted MRI (DWI)-ASPECT score in patients presenting within 6 hours of symptom onset of ischemic stroke.

Methods

Patient cohort

Data were extracted from a single center prospective registry from the Montpellier Stroke database who were admitted between August 2009 and August 2015 with a clinical and imaging diagnosis of acute stroke and a defined time of symptom onset as well as a defined time at which MRI was performed. Consecutive anterior circulation stroke patients ($n = 203$) with large vessel occlusion

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Table 1
Patient's characteristics.

Variable	ASPECT				*P*-value[b]
	Total	< 3, *n* = 28	4–6, *n* = 87	> 7, *n* = 114	
Age, mean(SD)[a]	67.1 (12.6)	63 (10.0)	67.3 (12.2)	68.0 (13.3)	0.054
Sex					0.176
Women	102 (44.5)	9 (32.1%)	36 (41.4)	57 (50.0)	
Men	127 (55.5)	19 (67.9)	51 (58.6)	57 (50.0)	
Hypertension	119 (56.4%)	14 (51.8)	47 (58.8)	58 (55.8)	0.809
Tobacco	64 (31.5%)	11 (40.7)	28 (35.9)	25 (25.5)	0.183
Dyslipidemia	72 (34.4%)	5 (18.5)	33 (40.7)	34 (33.7)	0.106
Diabetes	35 (16.8%)	4 (14.8)	15 (18.8)	16 (15.8)	0.835
Stroke	74 (36.3%)	6 (22.2)	34 (43.6)	34 (34.3)	0.118
NIH, mean (SD)[a]	18.2 (5.4)	21.8 (5.0)	19.5 (5.1)	16.2 (4.9)	< 0.001

[a] Kruskal-Wallis test, $P < 0.05$.
[b] Pearson's Chi-^{2} test, $P < 0.05$.

(LVO) (M1 middle cerebral artery and intracranial carotid artery) who had a MRI performed within the first 6 hours after the onset of symptoms and with a defined time of symptoms onset and of MRI were retrieved from the database for analysis. A larger proportion of patients were treated with thrombectomy ($n = 174$) compared with non-treated patients ($n = 29$). The study was approved by the institutional review board.

DWI-MRI

MRI scans were performed on 2 different scanners (Siemens Avanto1.5 T and Siemens Skyra 3.0 T). On the 1.5 T scanner, the sequence parameters were: TR = 24 ms, TE = 6.00 ms, flip angle = 90, 3 directions of measurement, 16 cm FOV, 131 × 131 matrix, 5 mm section thickness. On the 3 T scanner, the sequence parameters were: TR = 6300, TE = 78, flip angle = 90, EPI factor 128, 3 directions of measurement, 24 cm FOV, 128 × 128 matrix, 5 mm section thickness. Scanners used 20 (3 T) channels and 12 (1.5 T) head coils. Foci of diffusion were measured in the longest axial axis. DWI *b*-value was $b = 1000$ for all studies. All patients were scanned with the same protocol.

The patients were grouped according to the number of hours after the onset of symptoms until the MRI was performed (0–1 h, 1–2 h, 2–3 h, 3–4 h, 4–5 h, 5–6 h). Two experienced neuroradiologists independently calculated the DWI-ASPECT score, which was then classified by the size of the stroke according to the DWI-ASPECT score [12] into previously defined categories [13]: very large stroke DWI-ASPECT score 0–3 (> 100 ml), large stroke DWI-ASPECT 4–6, (30 to 70 ml) and minor stroke volume DWI-ASPECT 7–10 (< 30 ml).

Statistics

The analyses of the relationship between ASPECT score and the time point at which the MRI was performed after symptom onset was performed using STATA (StataCorp. 2007. Stata Statistical Software: Release 10. College Station, TX: StataCorp LP). We performed a descriptive analysis, presenting absolute values and percentages

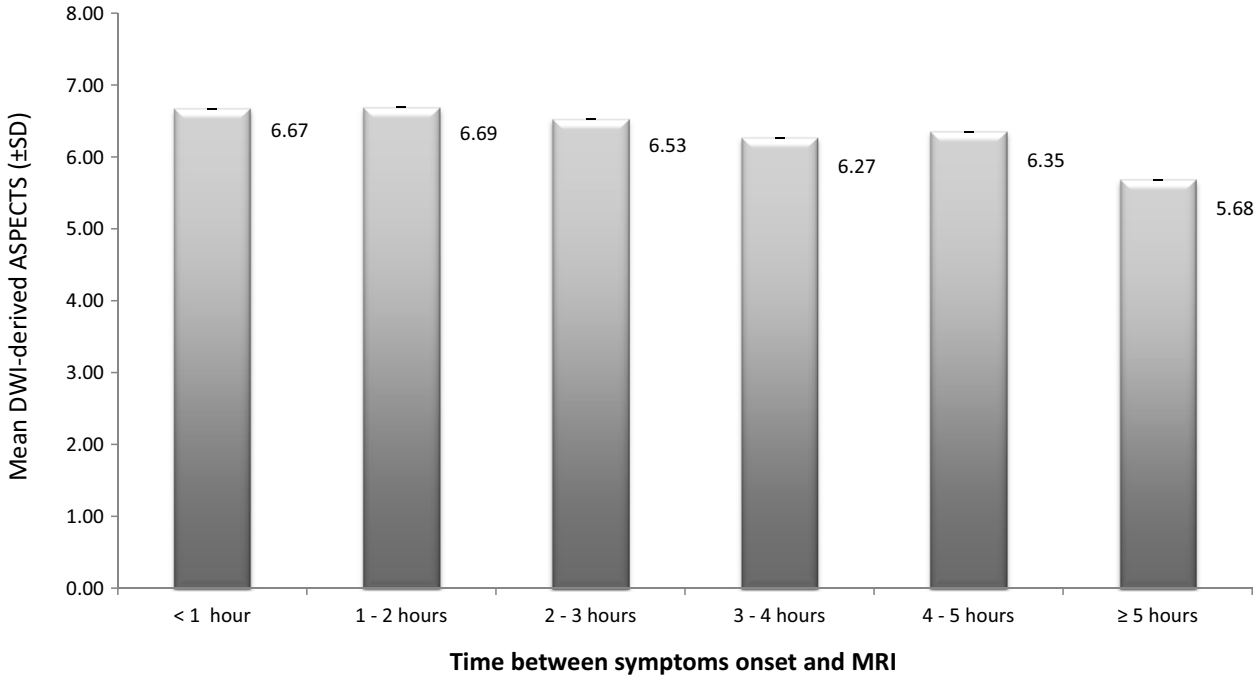

Fig. 1. Mean DWI ASPECT score in each hour from symptom onset shows no significant differences between time groups.

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