Letter to the Editor

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Brain CT Perfusion in Stroke in Progression

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Dear Sir,

Brain CT perfusion imaging (CTP) has been used to study cerebral blood flow (CBF) in acute ischemic [1] and hemorrhagic [2] stroke, vasospasm secondary to subarachnoid hemorrhage [3] and in brain trauma [4]. CTP using new generation multislice scanners is a relatively recent technique with the potential of becoming a widely used tool of standard stroke assessment due to its better access in general medical emergency departments compared to magnetic resonance perfusion [5]. In patients with suspected acute stroke the site of vascular occlusion, infarct core, salvageable brain tissue and collateral circulation is best assessed by a combination of CTP and CT angiography [6, 7]. CTP may help decision-making for thrombolysis when there is no clear time of symptom debut [8]. Moreover, as shown below, CTP may assist decision-making for endovascular neuroradiologic treatment in patients with stroke in progression. To our knowledge, this is the first report of brain CTP in stroke in progression due to middle cerebral artery (MCA) occlusion.

Case Report

A 75-year-old woman with a history of well-treated hypertension presented to our neurological emergency department with right-sided hemiparesis, hemianopia, gaze paresis and global aphasia. Her initial NIHSS score was 15. An acute CT brain scan revealed subtle hypodensity of the left MCA territory with narrowing of the proximal MCA on CT angiography (fig. 1a). Due to symptom regression during the next 30 min and the unknown time of symptom onset, aspirin was given but not thrombolysis. The next morning she had minimal dysphasia and central facial paresis only (NIHSS score 2). However, her symptoms were fluctuating and on day 3 she again progressed to global aphasia. Brain CT with angiography was unchanged (fig. 1a). Brain CTP was performed, consisting of a 50-second series using cinemode scanning and nonionic contrast medium, which is believed to have no brain damaging effects during acute stroke [9]. A significant decrease of relative cerebral blood flow (rCBF) to approximately 30 ml/100 g brain tissue/min in the left MCA territory was seen (fig. 1b). Conventional angiography with angioplasty of the occluded M1 segment was performed. Due to immediate normalization of the blood flow we renounced stenting. After the procedure our patient again exhibited minimal dysphasia only. Brain CTP 2 days and angiography 8 days later showed complete restoration of rCBF to approximately 70 ml/100 g/min (fig. 2a and b). Magnetic resonance imaging on day 5 revealed minor infarcts in the left insular lobe and internal capsule. Despite extensive cardiovascular workup an embolic source was not found. Having made a full recovery, the patient was discharged 2 weeks after admission. The neurologic status was unremarkable on follow-up 6 months later.

Discussion

In a recent report Hellier et al. [8] showed that CTP together with plain CT can assist decision-making on whether or not thrombolysis should be administered even though the exact time of stroke onset is uncertain. Although the authors did not know if stroke onset was within the usual time frame of 3 h, they treated 2 patients with rt-PA with excellent outcome based on the results of CTP and CT [8].

To our knowledge the only long-term study on CTP after neurointervention with angioplasty and stenting has been performed by Trojanowska et al. [10], showing that CTP can document improvement of CBF on follow-up. Six months after stenting 83% of patients with carotid artery stenosis and concurrent contralateral carotid artery occlusion had restored perfusion, while this was the case in 94% of patients with unilateral carotid artery stenosis [10]. However, in contrast to these patients with symptomatic stenosis of the internal carotid, our patient suffered from MCA occlusion.

It can be stated that CTP can monitor the effectiveness of endovascular neuroradiologic treatment in patients with stroke in progression. Moreover, the mismatch...
Fig. 1. CT angiography (a) shows proximal occlusion of the MCA at the M1 segment (arrow), while on brain CTP (mean transit time; b) the perfusion deficit is seen in the corresponding territory.

Fig. 2. After successful angioplasty and symptom regression CT angiography (a) and CTP (b) reveal normalized CBF.
between cerebral blood volume, rCBF and mean transit time on CTP may possibly be used to identify the tissue at risk, the amount of which guides decision-making for intervention with thrombectomy/thrombolysis or angioplasty with or without stenting. Although the size of the penumbra could not be exactly defined, rCBF in our patient was approximately 30 ml/100 g/min before intervention and significantly above the ischemic threshold. Thus, a positive outcome was considered likely, as indeed shown by the clinical course. In conclusion, the addition of CTP to conventional noncontrast brain CT might increase the efficacy and safety of angioplasty to the MCA.

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References