

Case 7

Acute Left Hemispheric Ischemic Stroke: Comprehensive Stroke Imaging Using Neuro Volume Perfusion CT

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HISTORY

A 75-year-old female patient with history of arterial hypertension, diabetes mellitus and absolute arrhythmia was admitted to the neurological clinic with symptoms of acute stroke. Two hours prior, the patient had developed an acute, right-sided hemiplegia and a right-sided facial palsy. On physical examination the patient was global aphasic, showed a left-sided eye and head deviation and recurrent emesis (NIHSS 26).*

Furthermore, a significant prolongation of the mean transit time (MTT, Fig. 2C) and the time to peak (TTP) in both the complete MCA and ACA territories were found. On CT-Angiography (CTA), occlusion of the main stems of the left MCA (Fig. 3) and ACA were detected. Due to the presence of a large penumbra volume, it was decided to perform

intra-arterial thrombolysis and to start a bridging therapy with 20 mg rt-PA immediately. Unfortunately, both thrombolysis therapies were unsuccessful (Fig. 4). Two days later, the follow-up NECT showed the delineation of complete territory infarctions of the MCA and ACA, brain edema and severe mid-line herniation (Fig. 5).

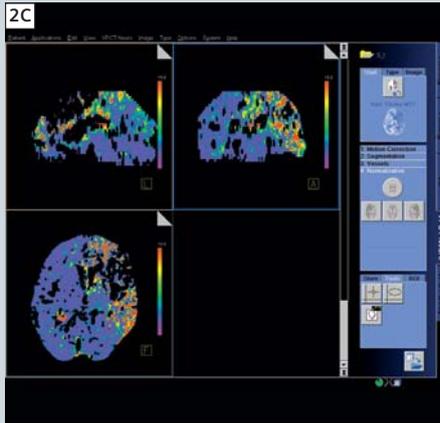
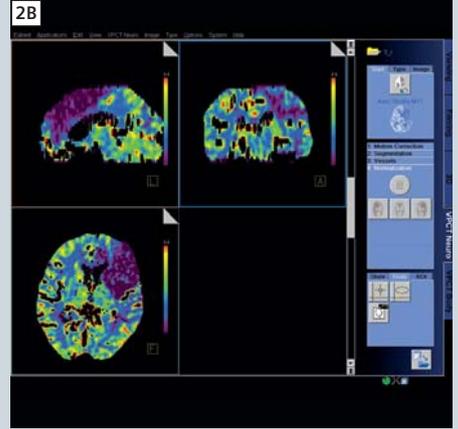
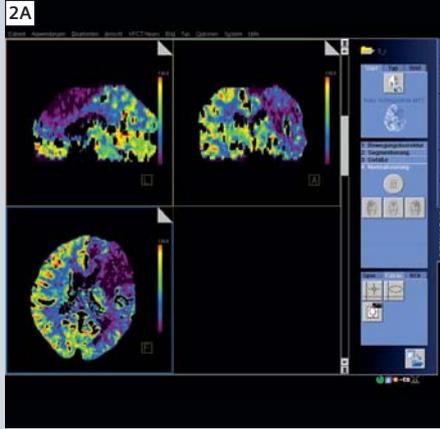
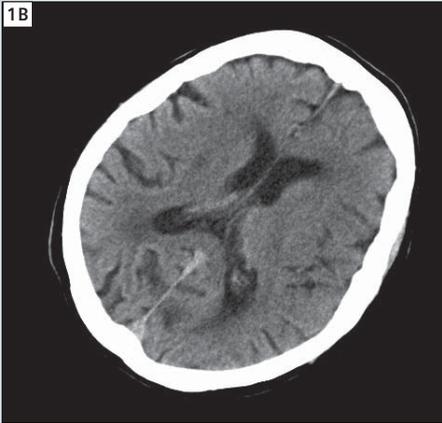
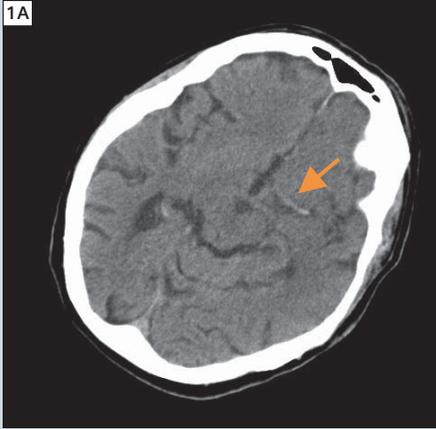
DIAGNOSIS

On initial non-enhanced cranial CT (NECT), intracranial hemorrhage and tumor were ruled out. A hyperdense media sign on the left side was visible as an early sign of ischemic stroke (Fig. 1A). However, grey and white brain matter appeared normal (Fig. 1B). Volume perfusion CT (VPCT) indicated large areas of restricted brain perfusion in the left hemisphere. A substantial reduction of values of cerebral blood flow (CBF, Fig. 2A) as well as reduction of cerebral blood volume (CBV, Fig. 2B) were detected in the anterior and middle parts of the left middle cerebral artery (MCA) territory and in parts of the left anterior cerebral artery (ACA) territory.

EXAMINATION PROTOCOL

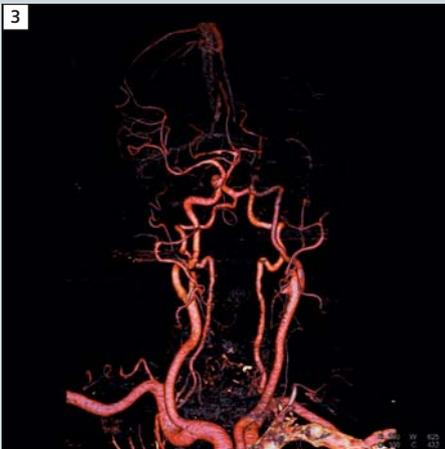
Scanner	SOMATOM Definition AS+ CT -Perfusion	SOMATOM Definition AS+ CTA Vessel analysis
Scan area	head	head
Scan length	96 mm (VPCT)	300 mm
Scan direction	cranio-caudal	cranio-caudal
Scan time	40 s, one scan every 1.5 s	2.91 s
Tube voltage	80 kV	120 kV
Tube current	200 Eff. mAs	120 Eff. mAs
Scan mode	Adaptive 4D Spiral	Spiral
eff. dose	5.2 mSv	3.1 mSv
Rotation time	0.3 s	0.3 s
Slice collimation	0.6 mm	0.6 mm
Slice width/Increment	5 mm/3 mm	1.5 mm/1 mm
Reconstruction kernel	H20f	H20f
Contrast		
Volume/Flow rate	35 ml iomeprol 350 @ 5 ml/s 20 ml NaCl @ 5 ml/s	40 ml iomeprol 350 @ 5 ml/s 25 ml iomeprol 350 @ 2,5 ml/s 20 NaCl @ 2,5 ml
Start delay	4s	4s
Postprocessing	syngo Volume Perfusion CT – Neuro (VPCT-Neuro)	Bolus tracking syngo Neuro DSA

*NIHSS 26 (National Institute of Health Stroke SCORE 26).



1 A hyperdense media sign on the left side was visible as an early sign of ischemic stroke (Fig. 1A, arrow). However, the differentiation of grey and white brain matter appeared normal (Fig. 1B).

2 Volume perfusion CT (VPCT) indicated substantial reduction of values of cerebral blood flow (CBF, Fig. 2A) as well as reduction of cerebral blood volume (CBV, Fig. 2B) were detected in the anterior and middle parts of the left MCA territory and in parts of the left ACA territory. Furthermore, a significant prolongation of the mean transit time (MTT Fig. 2C) could be observed. A large penumbra could be detected (yellow) in regards to a smaller core infarct (red, Fig. 2D). Therefore intra-arterial lysis was indicated.



3 Due to complete stroke assessment the CTA revealed an occlusion of the main stem of the left MCA.

4 Intraarterial thrombolyses failed to open left MCA.

5 Follow-up NECT showed the delineation of complete territory infarctions of the MCA and ACA, brain edema and severe midline herniation.

COMMENTS

With VPCT, analysis of the brain perfusion parameters of the whole brain is possible. Contrary to standard perfusion CT, which allows analysis only of restricted areas of the brain depending on the

detector width, even smallest areas of hypo-perfusion can now be analyzed throughout the whole brain with VPCT. Therefore, the advent of VPCT renders important information about the com-

plete volume of tissue at risk of infarction and should be implemented in a comprehensive stroke CT protocol.