Journal of Thrombosis and Circulation Open Access

Amelung et al., J Thrombo Cir 2016, 2:3

Case Report Open Access

Evaluation of an Acute Stroke Patient with Flat Detector CT Prior to Mechanical Thrombectomy

Nadine Amelung[1]*, Daniel Behme[2], Michael Knauth[2] and Marios Nikos Psychogios[2]

[1]*University Medical Center Göttingen, Diagnostic and Interventional Neuroradiology, Robert Koch Straße 40, Göttingen, Germany*
[2]*Georg August University Göttingen, Germany*

Abstract

Flat panel detectors have revolutionized tomographic imaging in the angio suite. Recent developments in hardware and software have improved soft tissue resolution and acquisition time even further, enabling soft-tissue and perfusion imaging within the angio suite. The so called "one-stop-shop" stroke imaging with flat panel detector computed tomography (FDCT) will significantly improve door to groin times and probably have an impact on patient outcome. In the presented case a patient underwent multidetector CT (MDCT) to exclude hemorrhage, then MDCT angiography (MDCTA) to identify the occluded vessel, and MDCT perfusion (MDCTP) for penumbra imaging. Patient's symptoms significantly improved during transport to the angiography suite. Thus, prior to intervention, multimodal FDCT with vessel and perfusion imaging was acquired and ultimately led to cancelation of the interventional therapy. In this clinical scenario, multimodal FDCT imaging can provide quick answers and eliminate the risk of an invasive angiography in cases of reperfusion prior to mechanical thrombectomy.

Keywords: Flat-detector CT; Stroke imaging; One-stop-shop; Rotational Angiography; Thrombectomy; Thrombolysis; Flat-detector-CT-angiography

Abbreviations: MDCT: Multidetector CT; MDCTA: Multidetector CT Angiography; MDCTP: Multidetector CT Perfusion; FDCT: Flat Detector CT; FDCTA: Flat Detector CT Angiography; FDCTP: Flat Detector CT Perfusion; CBF: Cerebral Blood Flow; CBV: Cerebral Blood Volume; TTD – Time to Drain; ASPECTS: Alberta Stroke Program Early CT Score

Background

Ischemic stroke is one of the most common causes for morbidity and mortality in industrialized countries [1]. Currently treatment decisions are made mainly based on the time elapsed since onset of first clinical symptoms, severity of the clinical deficits, and MDCT-imaging based criteria. MDCT-imaging always includes conventional non-enhanced MDCT as well as MDCTA, and can be amended by MDCTP. MDCT detects intracranial bleeding, leading to an exclusion of thrombolytic and endovascular therapy. Early signs of ischemia and the extent of demarcated infarcted brain parenchyma are also displayed by MDCT and are taken into consideration regarding systemic and interventional stroke therapy. MDCTA identifies an intra-arterial blood clot or high-grade arterial stenosis causing an ischemia. MDCTP reveals a mismatch between ischemic parenchyma and core identifying tissue at risk ("penumbra"). If the ischemic core is small and the penumbra is large, a therapeutic intervention is more likely to result in a favorable outcome [2].

Usually, pre-interventional imaging is based on MDCT imaging. If a patient is eligible for an interventional treatment he is moved to the angiography suite for further therapy. FDCT has been implemented in the angio suite to improve peri-interventional imaging and work flow. Multiple publications suggest that FDCT can sufficiently display hemorrhage or ischemia in the peri-interventional setting [3,4]. Also, in cases of complex three-dimensional vessel structures that cannot be displayed by conventional DSA or if the optimal imaging plane could not be established due to collision of the C-arms and the table [5]. FDCTA has proven to be a valuable tool for displaying vessel anatomy [6]. Perfusion parameters reconstructed from FDCTP datasets have been shown to be comparable to MDCTP parameters [6]. The availability of multimodal FDCT in the angio suite can lead to a "one-stop-shop" imaging in the near future, with significant time saving effects for stroke patients with major vessel occlusion. Additionally, multimodal FDCT provides neuroradiologists with a useful tool for direct post interventional assessment of the brain parenchyma.

Case Presentation

A 54-year-old male patient was admitted to the hospital after sudden onset of global aphasia. Clinical examination additionally revealed a right side neglect and disorientation to time, resulting in an NIHSS of 6. The patient was not eligible for rtPA due to therapeutic anticoagulation after mitral valve mechanical replacement (INR of 3.4 at admission).

The initial MDCT showed a dense artery sign in the lateral sulcus and no other early signs of ischemia in the left middle cerebral artery (MCA) territory (Figure 1). A hemorrhage could be excluded. MDCTA of the extra- and intracranial vessels showed a proximal M2-occlusion of the temporal branch. MDCTP showed a reduced CBV in the left temporooccipital region, when compared to the opposite side, as well as a CBF-ASPECT Score of 7 with reduced blood flow in the left temporooccipital region.

With an NIHSS of 5 the patient was transferred to the angiography suite for mechanical thrombectomy of the left MCA. In the angio suite, the interventional neuroradiologist saw an improvement

***Corresponding author:** Nadine Amelung, University Medical Center Göttingen, Diagnostic and Interventional Neuroradiology, Robert Koch Straße 40, Göttingen, 37075, Germany, Tel: 00495513914024, Fax: 00495513912868; E-mail: nadine.amelung@med.uni-goettingen.de

Received August 10, 2016; **Accepted** September 24, 2016; **Published** September 30, 2016

Citation: Amelung N, Behme D, Knauth M, Psychogios MN (2016) Evaluation of an Acute Stroke Patient with Flat Detector CT Prior to Mechanical Thrombectomy. J Thrombo Cir 2: 114.

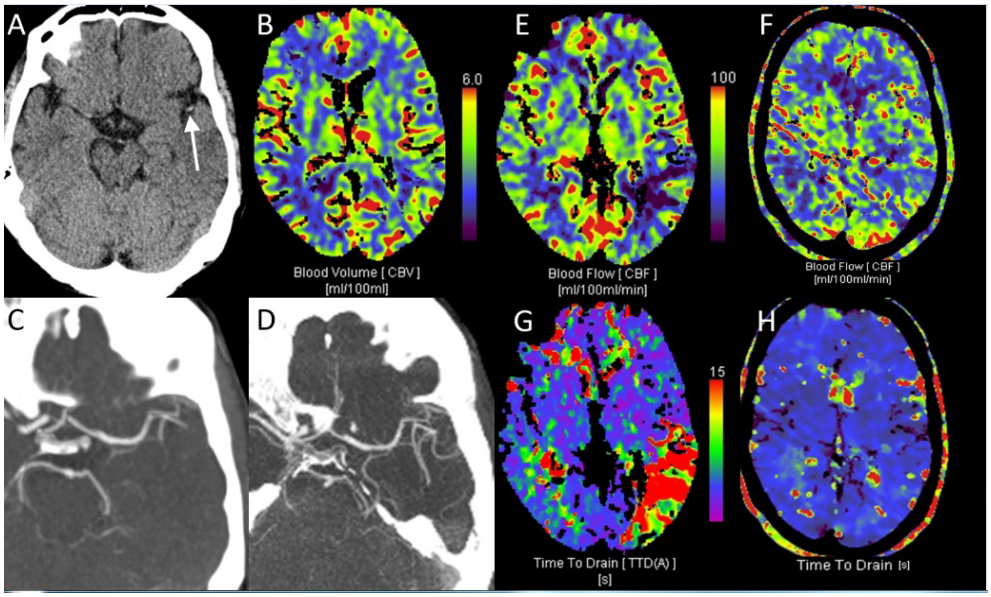

Figure 1: (1A). MDCT displayed a dense artery sign in the left MCA. Other early signs of infarction or intracranial haemorrhage could not be detected. (1B). MDCTP CBV map showed a slightly reduced blood volume in the left temporooccipital region as opposed to the right hemisphere. (1C). MDCTA showed the abrupt stop of contrast agent in the left proximal temporal M2 segment. (1D). In FDCTA the left proximal M2-segment is patent.
(1E). CBF maps acquired via MDCTP show a reduced blood flow in the left temporooccipital region leading to a CBF-ASPECTS Score of 7. (1F). Corresponding to the improvement of the patient's clinical symptoms, the CBF map acquired via FDCTP showed a normalized CBF. (1G). Increased time to drain in the initially acquired TTD map in MDCTP in the left temporooccipital region. (1H). Normalized TTD in the FDCTP after the patient's symptoms improved.

of the patient's clinical symptoms. Thus, a FDCTA and FDCTP were acquired in the angio suite. Multiplanar reconstructions of the intracranial vessels were made, depicting resolution of the thrombus and patency of the left temporal M2 segment. In addition, FDCT perfusion showed cerebral blood flow improvement and normalization of CBF and time to drain.

Based on the improvement of clinical symptoms, the reperfusion of the left temporal M2 segment, shown by FDCTA, and the improved perfusion maps, endovascular therapy was cancelled and the risks of an invasive angiogram could be avoided.

After admission to the stroke unit the patient received multimodal stroke therapy and optimization of cardiovascular risk factors. During his stay the neurologic deficits disappeared and the patient could leave the hospital without any symptoms.

Conclusions

FDCT-Perfusion imaging is a technique, which can be used in the acute stroke setting. Like multimodal MDCT-imaging, FDCT imaging can provide information about the anatomic and functional aspects of brain parenchyma regarding the acute stroke imaging [6]. In recent studies it has also been shown, that multimodal FDCT-imaging, including FDCTA and FDCTP, is comparable to multimodal MDCT-imaging, concerning the site of the occlusion and the perfusion images [7]. In the presented case, the perfusion maps acquired via FDCTP correlated well with the initial conventional CT-perfusion maps. Our case also suggests that multimodal FDCT will be an actual option for a one-stop-shop stroke treatment in the future.

References

1. Gröschel K, Schnaudigel S, Pilgram SM, Wasser, K, Kastrup A (2009) A Systematic Review on Outcome After Stenting for Intracranial Atherosclerosis. Stroke 40: e340-e347.
2. Campbell BCV, Mitchell PJ, Kleinig TJ, Dewey HM, Churilov L et al. (2015) Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection. N Engl J Med 372: 1009-1018.
3. Kamran M, Nagaraja S, Byrne JV (2010) C-arm flat detector computed tomography: the technique and its applications in interventional neuro-radiology. Neuroradiology 52: 319-327.
4. Psychogios MN, Buhk JH, Schramm P, Xyda A, Mohr A, et al. (2010) Feasibility of Angiographic CT in Peri-Interventional Diagnostic Imaging: A Comparative Study with Multidetector CT. AJNR Am J Neuroradiol 31: 1226-1231.
5. Namba, K, Niimi Y, Song JK, Berenstein A (2009) Use of Dyna-CT Angiography in Neuroendovascular Decision-Making: A Case Report. Interv Neuroradiol 15: 67–72.
6. Struffert T, Deuerling-Zheng Y, Kloska S, Engelhorn T, Strother CM, et al. (2010) Flat Detector CT in the Evaluation of Brain Parenchyma, Intracranial Vasculature, and Cerebral Blood Volume: A Pilot Study in Patients with Acute Symptoms of Cerebral Ischemia. AJNR Am J Neuroradiol 31: 1462–1549.
7. Struffert T, Deuerling-Zheng Y, Kloska S, Engelhorn T, Lang S, et al. (2015) Dynamic Angiography and Perfusion Imaging Using Flat Detector CT in the Angiography Suite: A Pilot Study in Patients with Acute Middle Cerebral Artery Occlusions. AJNR Am J Neuroradiol 36, 1964-1970.

Citation: Amelung N, Behme D, Knauth M, Psychogios MN (2016) Evaluation of an Acute Stroke Patient with Flat Detector CT Prior to Mechanical Thrombectomy. J Thrombo Cir 2: 114.