Comparing CT to MRI in acute Stroke: large vessels and perfusion

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Learning Objective: Computed tomography (CT) is an established tool for the diagnosis of ischemic or hemorrhagic stroke. The learning objective of this lecture is to assess the utility of multimodal CT in the depiction of acute stroke in comparison to the methods of MRI and MRA.

Multisection CT allows the combined use of three imaging modalities—nonenhanced CT, perfusion CT, and CT angiography—to rapidly obtain comprehensive information regarding the extent of ischemic damage in acute stroke patients. Specific patterns of findings are typically seen in ischemic stroke and can be analyzed accurately with the combined use of multisection CT and MR imaging.

A protocol of multimodal CT including unenhanced CT, CT-perfusion with suggestions of adequate protocols, and CT-angiography will be presented and discussed for different multislice CT-units. Inclusion criteria of the local multimodal CT protocol include a potential clinical indication for intravenous thrombolysis (rTPA), imaging within three to six hours after stroke onset and neurological suggestion of territorial stroke in the anterior hemispheres, age over 18 and informed consent by the patient or next to kind. Contraindications for the multimodal CT protocol include the detection of an intracranial bleeding, suspicion of an AVM, intracranial aneurysm, or early ischemic signs covering more than 1/3 of the Media territorium.

Recent developments in detector design facilitates, that CT angiography can reliably help detect stenosis or occlusion of extra- and intracranial arteries, even in patients not able to cooperate well. Regarding assessment of CTA, pitfalls in diagnosis and interpretation will be presented. Secondly, a comparison of MRA and CTA in the different anatomical regions, specifically the origin of vertebral artery, the carotid bifurcation, the petrous and the cavernous section of the carotid artery, and the intracranial vessels will be demonstrated.

Perfusion CT provides information about brain perfusion analogous to MRI-based data, which permits differentiation of irreversibly damaged brain tissue from reversibly impaired
“tissue at risk.” Regarding perfusion data, contrast noise ratios as well as clinical examples will be given, based on available contrast agents.

Recently published prospective studies involving larger number of patients have evolved to outline the value of multimodal CT for patients suffering with acute stroke. However, the role of multimodal CT (in opposition to MRI) as a guide to dedicated stroke therapy such as mechanical recanalisation will have to be based on broader evidence.

Recommended literature:

- Wintermark, M.; Flanders, Adam E.; Velthuis, B; Meuli, Reto; van Leeuwen, M.; Goldsher, D; Pineda, C.; Serena, J; van der Schaaf, I; Waaijer, A; Anderson, J; Nesbit, G; Gabriely, I.; Medina, V.; Quiles, A; Pohlman, S; Quist, M; Schnyder, P; Bogousslavsky, J; Dillon, WP; Pedraza, S. Perfusion-CT Assessment of Infarct Core and Penumbra Receiver Operating Characteristic Curve Analysis in 130 Patients Suspected of Acute Hemispheric Stroke. Stroke. 2006;37:979-985.