Metabolism of hyperperfused tissue after stroke reperfusion therapy.

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Introduction: There is little data on the metabolic status of brain tissue immediately after reperfusion. Not all post-treatment reperfusion is associated with a good outcome, and recent studies using MR perfusion imaging with arterial spin labeling (ASL), have identified that patients with hyperperfusion shortly after treatment have a better clinical recovery than those who reperfuse without hyperperfusion. This study aimed to investigate the potential mechanisms of hyperperfusion using magnetic resonance spectroscopy (MRS). **Methods**: Ischemic stroke patients who were treated with thrombolysis following perfusion CT were recruited. Twenty-four hours after intravenous thrombolysis patients were scanned with short echo-time MRS (single voxel spectroscopy, PRESS, TE 30), ASL, and diffusion weighted imaging (DWI). Salvaged penumbral tissue was determined as initially hypoperfused tissue on CTP that did not progress to infarction on DWI. Hyperperfused tissue as defined on ASL as CBF >130% compared to contralateral tissue. An MRS voxel was placed in the reperfused penumbral cortex. Additionally 20, healthy age matched controls underwent MRS scanning.

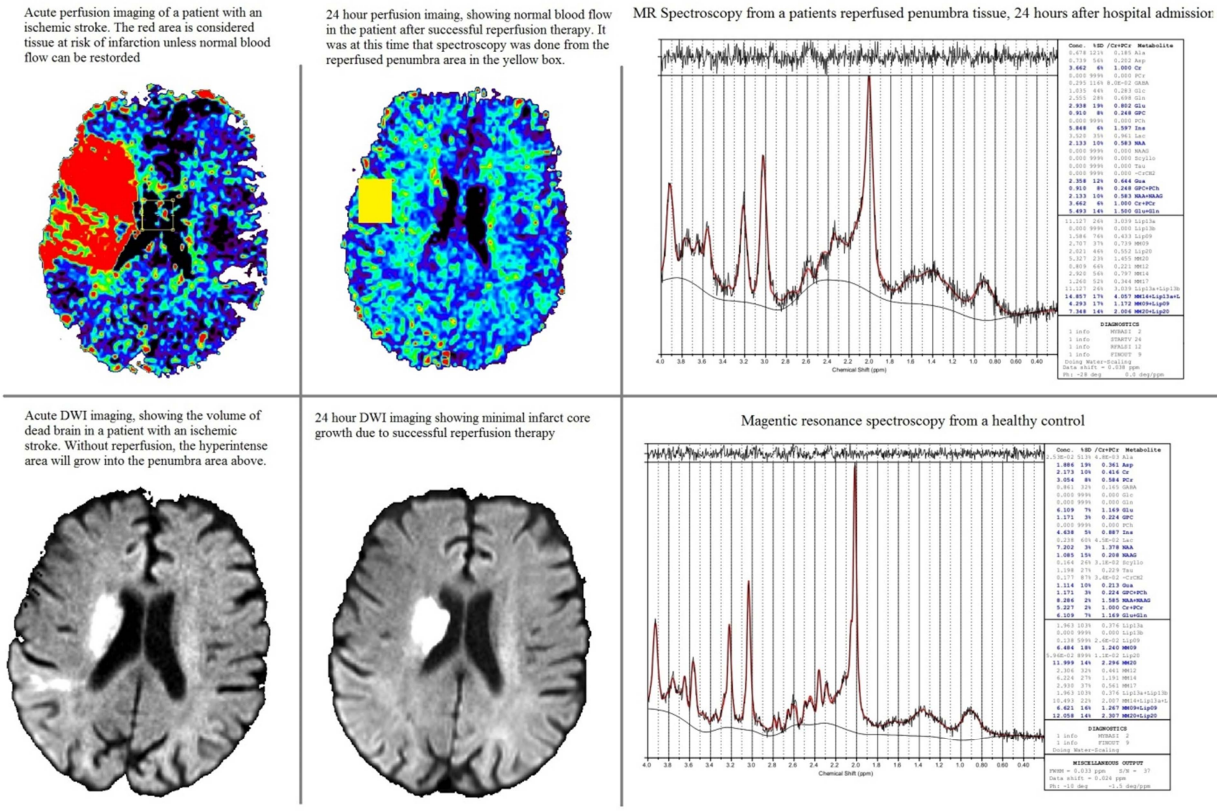

Figure 1. Placement of MR spectroscopy (MRS) voxels using previous acute imaging as a reference. Identification of hyperperfused tissue required acute CT perfusion imaging (first column). Next, 24 hour MRI using arterial spin labeling (ASL) and diffusion weighted imaging (DWI) was performed to measure reperfusion. MRS voxels were placed in the reperfused region on ASL that did not infarct on DWI (Yellow box) to measure metabolic concentrations (MRS metabolites measured include: total creatine (CR), Glutamate (GLU), N-Acetylaspartate (NAA) and total choline (CHO).

Results: 77 Patients were enrolled in this study: 24 with hyperperfusion; 36 with reperfusion but not hyperperfusion, and 17 were excluded due to lack of reperfusion or motion-affected MRS. Hyperperfusion was significantly related to better 3 month clinical outcome compared to patients without hyperperfusion (p=0.007). Patients with hyperperfusion showed increased glutamate (p<0.001), NAA (p=0.038) and lactate (p<0.002) in reperfused tissue compared to contralateral tissue, patients without hyperperfusion, and 'healthy' controls. **Discussion**: A unique metabolic signature of hyperperfused tissue was observed. The metabolic differences between the two groups may explain why patients with hyperperfusion have a much better clinical recovery following reperfusion.