Applications: acute stroke

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Syllabus

Dynamic susceptibility contrast perfusion weighted imaging (DSC-PWI) is part of the clinical acute MR stroke protocol in many centers worldwide [1]. The PWI derived maps of cerebral hemodynamics are used in a variety of ways to guide clinical decision making such as thrombolysis in late time windows or so called bridging therapies, where the patient is offered more invasive intra-arterial thrombolysis if perfusion imaging shows lack of response (no reperfusion) to intravenous tPA.

A key goal of perfusion weighted imaging, as a diagnostic tool, is to predict the tissue areas that will infarct in the absence of reperfusion. When used in combination with diffusion weighted imaging, this provides estimate of the tissue-at-risk which is useful both for clinical decision making as well as a baseline covariate in trials.

This talk will discuss:

1) What characterizes the ideal perfusion image for use in acute stroke imaging and how can this be quantified with Receiver Operating Characteristics analysis.

2) Which patient groups should be used to address this type of question? The concepts of penumbral- and infarction thresholds will be discussed and related to the reperfusion status of the patient. Evidence will be reviewed.

3) An overview of current PWI post processing methods and the evidence to support these methods. PWI post processing algorithms can broadly be divided into two groups, deconvolution based and non-deconvolution based. Deconvolution methods can further be classified by deconvolution algorithm as well as Arterial Input Function (AIF) selection approach (global or local). Deconvolution can offer correction for extra-cerebral factors as well as intracranial delay and dispersion and theoretically provide less biased estimates of MTT and CBF. Non-deconvolution based parameters are generally sensitive to delay and dispersion but can be partially normalized for extra-cerebral factors through contra-lateral normalization procedures.

3) Integration of multiple imaging modalities into the infarct prediction using predictive models. A brief overview of published literature will be presented with a discussion of methodology.

4) Using perfusion images for patient selection. How do we turn images into a decision and what are the main obstacles that need to be overcome before this technique can be used more widely?

5) A brief overview of recent trials that have employed perfusion based selection and what we can learn from these trials.