Multiparametric MR Guidance of Acute Stroke Treatment

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It is hard to overestimate the impact of MRI on the diagnosis and management of acute ischemic stroke in humans. The exquisite sensitivity of diffusion weighted imaging to detect early ischemic events shown nearly 20 years ago has promulgated into clinical practice throughout the world and has become the accepted standard for the diagnosis of stroke. Confirming the simple presence or absence of acute ischemic damage is extremely helpful because so many neurologic signs and symptoms can be caused by ischemia. In addition, the spatial pattern of diffusion abnormalities can be very helpful in determining the cause of the stroke and the long term prognosis and even management decisions.

There has also been tremendous interest in perfusion MRI, and the potential to couple diffusion and perfusion together to create an imaging correlate to the ischemic penumbra. Many groups have pursued investigation of this combination and a number of important insights have been made.

While these imaging tools have appeared very promising, stroke remains difficult to treat effectively. The vast majority of therapeutic interventions have been shown to lack efficacy, with the exception of reperfusion therapy with intravenous tissue plasminogen activator. Even this has been limited to the first few hours after the onset of symptoms, so only a minority of patients can be offered any proven treatment. There is therefore tremendous interest in the role that imaging might be able to play in extending the window of thrombolysis by identifying patients who might be candidates for late thrombolysis due to the persistence of salvageable tissue. Intense interest in identifying imaging markers for both salvageable tissue but also for patients likely to suffer harm (e.g., due to hemorrhagic transformation) continues today.

This lecture will review both these remarkable advances but also the substantial unmet needs in stroke. The current status of clinical trials that have attempted to validate the diffusion/perfusion mismatch as a marker for salvageable tissue will be reviewed, planned future trials will be discussed, and particular attention will be given to new methods that might provide the insight needed to combat this disease, one of the leading causes of death and disability throughout the world.