Diffusion and perfusion MRI of stroke

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Magnetic resonance imaging (MRI) has emerged as a leading technology in the diagnosis and care of the acute stroke patient because of the range of structural and physiological measurements possible in a relatively non-invasive and rapid manner and because of the wide dissemination and availability of MRI scanners in clinics and hospitals.

The ideal neurodiagnostic imaging exam for stroke must rule out intracranial hemorrhage, detect the presence of ischemic pathology (intracranial and extracranial arterial disease, ischemic parenchymal injury and brain hemodynamics), and be achievable in a brief scanning session. An emergency MRI exam including diffusion weighted (DWI), perfusion (PWI), MR angiography (MRA), susceptibility weighted and T2-weighted or FLAIR imaging meets all these requirements. At many institutions where emergency therapies and early diagnosis are part of stroke care, MRI has already taken on a role to accomplish the diagnostic objectives in acute stroke. Conclusions about the state of ischemic pathophysiology in an individual patient, once based solely on clinical conjecture in the first few hours after onset, may now be based on objective data as well. MRI has found a role in the decision making for thrombolytic therapy and in clinical trials. Clinical studies support the sensitivity and specificity of the MRI in early stroke diagnosis, predicting clinical outcome, predicting the fate of the tissue at risk at the earliest time points, and in demonstrating reversal of ischemic injury following successful early reperfusion. A reduction in ischemic lesion volume from very early DWI to final infarct is highly predictive of clinical recovery.

Imaging in clinical drug development and testing has become common and will become ever more important in Phase I and II clinical trials to evaluate brain pharmacokinetics, tissue viability, establish proof of pharmacological principle, and in Phase III trials to provide surrogate measures of potential clinical effects.