The Cerebral MRI perfusion study: Promise, limitations and current relevance in neuroradiology

Cerebral MRI perfusion is based upon rapid imaging of contrast changes, intravoxel, incoherent motion differentiation of diffusion from perfusion, and arterial water spin labeling, both single slice and multislice, using one of several algorithms. The intent of these efforts is to provide relative cerebral blood flow, relative cerebral blood volume, time to peak, and tissue mean transit time. The calculation of milliliters of blood per 100 grams of cerebral tissue per minute can be difficult to precisely quantitate and has led to the use of the term "hemodynamically weighted MRI". MR bolus tracking methods are used to most often generate qualitative data similar to nuclear medicine SPECT. Arterial spin labeling methods under some implied assumptions can generate quantitative perfusion data. Zenon CT and oxygen 15 PET are currently recognized standards for brain perfusion values. Limitations of MR perfusion technology focus upon artifacts, limited signal to noise, and lack of efficiency. Other deficiencies include unwanted magnetization transfer contrast, vascular (transit time) effects, and imprecise arterial inversion. The primary use for cerebral MRI perfusion is in acute stroke, the suggestion being made that an area of diminished cerebral perfusion greater than an area of abnormal brain diffusion indicates an ischemic penumbra prompting clinical consideration of intravenous or intra-arterial emergent thrombolysis. The cerebral MRI perfusion results are not always this specific however, and may confound image interpretation and be falsely negative. Reproducibility of noninvasive cerebral MRI perfusion could eventually be applied to cerebral trauma, chronic and degenerative disorders including Alzheimer's disease, metabolic derangements, infectious and inflammatory etiologies, and further extending work that has already

been performed with neoplasms.

Reference: Jezzard, P. Advances in Perfusion MR Imaging. Radiology 1998; 208: 296-299.

Educational Objectives

1. Recognize available methodology used in and data parameters produced by cerebral perfusion MRI examinations.
2. Understand the current limitations of cerebral perfusion MRI technology.
3. List several indications for cerebral perfusion MRI examinations.