

## *Perfusion Imaging: ASL, DCE & DSC*

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### **Highlights**

- Understand the kinetic models used to quantify blood-tissue exchange
- Identify ASL and DCE imaging sequences for assessing tracer extravasation

**Title:** Measuring Tracer Extravasation with ASL & DCE

**Target Audience** Imaging scientists and physicians interested in understanding the fundamentals of the tracer kinetics models used to quantify tissue hemodynamics and vascular permeability.

### **Introduction**

Imaging techniques sensitive to the leakage rate of a tracer from blood to tissue are used extensively in oncology since vascular permeability is an indicator of angiogenesis and, thereby, reflects tumour grade and treatment response. In addition to cancer imaging, there is a growing interest in using these techniques to study neurological diseases since increased blood-brain barrier permeability is an indicator of hemorrhagic transformation in ischemic stroke and has been suggested to be a contributing factor in the development of various forms of dementia including Alzheimer's. Dynamic contrast-enhanced (DCE) MRI is overwhelming the dominant approach for assessing vascular permeability (1). However, arterial spin labelling (ASL) methods have also been proposed and recent technical developments that have enhanced the SNR of ASL are improving the feasibility of these methods (2,3).

Despite the obvious differences between DCE MRI and ASL – most notably the use of an exogenous contrast agent compared to labelling endogenous arterial water – the underlying tracer kinetic models are very similar. The purpose of this presentation is to provide an overview of these modelling approaches with a focus on how vascular permeability is characterized. The unique challenges of adapting appropriate kinetic models to DCE MRI and ASL imaging protocols will also be discussed.

1. Sourbron SP, Buckley DL. Tracer kinetic modelling in MRI: estimating perfusion and capillary permeability. *Phys Med Biol* 2012;57(2):R1-33.
2. St Lawrence KS, Owen D, Wang DJ. A two-stage approach for measuring vascular water exchange and arterial transit time by diffusion-weighted perfusion MRI. *Magn Reson Med* 2012;67(5):1275-1284.
3. Hales PW, Clark CA. Combined arterial spin labeling and diffusion-weighted imaging for noninvasive estimation of capillary volume fraction and permeability-surface product in the human brain. *J Cereb Blood Flow Metab* 2013;33(1):67-75.