

Quantitative Dynamic Contrast-Enhanced (DCE) MRI - David L. Buckley, PhD

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Highlights

- **T1-weighted DCE-MRI can be used to measure tissue/tumor blood flow**
- **The techniques required can be incorporated into standard clinical exams**

Target audience: Clinicians working in body/oncological MRI interested in tissue & tumor perfusion

OBJECTIVE: To encourage the application of quantitative MRI in the clinic

The measurement of perfusion is important in many areas of medicine (e.g. oncology, physiology, liver, cardiovascular and lung disease). Information about perfusion and capillary function may be obtained by treating Gd-based extracellular contrast agents as tracers and following their kinetics (as opposed to the conventional approach, inject - wait - image once). In general transport of a contrast agent is determined by just 4 parameters: blood flow, capillary permeability-surface area product (a measure of vessel leakiness), blood volume and interstitial volume. Measurements in the liver or kidneys require a slightly different description.

The imaging techniques required to capture the kinetics of a contrast agent are fairly standard on modern MR systems but attention must be paid to spatial, temporal and contrast resolution. In particular, for quantitative MRI it's important to measure an arterial input function and this may restrict the choice of imaging approach. Nevertheless, as many studies employ contrast agents for clinical routine already, there are many opportunities to extend these exams and obtain quantitative data.

At the end of the lecture it should be clear that T1-weighted DCE-MRI can be used to measure blood flow and capillary permeability separately and in absolute units (ml/min/100 ml tissue) and that the imaging data required don't have to compromise standard clinical exams.

Recommended Reading

- Reviews:* A.M. Peters, Fundamentals of tracer kinetics for radiologists *Brit J Radiol* **71**:1116-1129 (1998)
S.P. Sourbron, D.L. Buckley, Tracer kinetic modelling in MRI: estimating perfusion and capillary permeability. *Phys Med Biol* **57**:R1-R33 (2012)
- Book:* A. Jackson, D.L. Buckley, G.J.M. Parker, Editors. Dynamic Contrast-Enhanced Magnetic Resonance Imaging in Oncology. Springer-Verlag (2005).