

**Session:** Technologies for Clinical Neuroimaging

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**Highlights:**

- Quantitative parameters derived from dynamic contrast-enhanced (DCE) MRI show promise for being part of clinical imaging for patients with brain tumor and cerebrovascular disease.
- The precise meaning of parameters such as  $K^{trans}$  (volume transfer constant between blood plasma and extracellular extravascular space) derived from DCE-MRI depend on the pharmacodynamic model used in analysis, and the choice of model determines to a large extent an appropriate imaging protocol.
- Further technical development and validation using multicenter trials will be needed before the promise of DCE-MRI can be realized.

**Title: DCE Perfusion**

**Target Audience:** Radiologists, physicists and technologists with an interest in DCE-MRI and its potential applications for patients with brain tumors and cerebrovascular disease.

**Objectives:** Attendees of this lecture will better understand the barriers that will need to be addressed before clinical uses of DCE-MRI can be validated, and how these barriers are similar to those faced by other advanced neuroimaging techniques. Attendees will be able to more intelligently design imaging acquisition and analysis protocols tailored to particular clinical applications.

**Purpose:** The purpose of this lecture is to review promising applications for DCE-MRI for evaluation of patients with high-grade brain tumors and acute stroke. We will discuss the reasons why despite years of widespread interest in DCE MRI no clinical applications using this technique have been broadly validated. Several significant challenges remain to successful implementation of clinical DCE-MRI, and the most promising techniques useful to meet these challenges will be discussed.

**Results:** Likely the most promising use case for DCE-MRI in brain tumor imaging is to allow early identification of patients for whom particular therapies, particularly anti-angiogenic therapies, have failed. In stroke imaging, perhaps the most promising use case is to better stratify risk in patients undergoing thrombolysis for acute stroke. Efforts to validate the utility of DCE-MRI for these use cases have been hindered by technical factors such as B1 inhomogeneity and limited image acquisition rates, and by lack of consensus about optimal image acquisition techniques, software used to create maps, and analysis techniques to extract quantitative metrics from maps. More information about the reproducibility of quantitative parameters (particularly across MRI scanners with differing field strengths and from different manufacturers) and about the effect size that correlates with patient outcome would be helpful for planning the multicenter trials needed to validate these uses.

Example strategies for more rapid DCE-MRI acquisition and for B1 inhomogeneity correction will be discussed. The ongoing efforts of the RSNA Quantitative Imaging Biomarker Alliance, including the use

of both real and simulated phantoms to evaluate DCE-MRI with the goal of eventually supporting multicenter clinical trials, will be reviewed.

**Conclusion:** Although significant barriers to validation of DCE-MRI for use in a clinical context remain, recent developments bring hope that well-designed multicenter clinical trials to evaluate DCE-MRI may be possible in the near future.

#### References:

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