

Towards an MRI Characterization of Individual Cancers  
for Staging, Treatment Selection and Monitoring Response

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A major challenge for diagnostic imaging is to better define the specific characteristics of individual tumors. Tumors sharing a particular histopathologic type may have widely divergent biological properties including molecular expression, angiogenesis status, and susceptibility to treatment. Through the use of innovative contrast enhancing pharmaceuticals, it now seems feasible to interrogate each patient's tumor, defining both functional and structural characteristics. One of the several appealing approaches now being developed for clinical use is the use of dynamic magnetic resonance imaging combined with novel macromolecular contrast media to quantitatively assess tumor microvessels. Using computer processing of the imaging data and a relatively simple two-compartment kinetic model, it is possible to non-invasively assay the relative blood volume, microvascular endothelial leakiness, and the interstitial volume of any solid tumor. The MRI permeability assay appears to be a particularly powerful biomarker, able to indicate a tumor's malignancy, its pathologic grade, its angiogenic status, and the tumor's responsiveness to drug therapy. Using MRI and macromolecular contrast media, tumor responses to treatment can be detected within hours of initiating therapy. Optimization of the dynamic MRI technique linked with the anticipated availability of new macromolecular contrast media should lead to an even greater future benefit from diagnostic imaging in cancer patients.

Learning objectives:

- To comprehend the diagnostic benefits afforded by MRI enhanced with novel macromolecular contrast agents for the characterization of individual tumors.
- To understand the principles of altered microvascular permeability and how abnormal permeability relates to angiogenesis and tumor aggressiveness.
- To learn how the effects of anti-angiogenic therapy can be monitored by macromolecular enhanced MRI.