Dynamic contrast enhanced (DCE) MRI is increasingly being used to assess tissue permeability and blood flow. DCE-MRI is performed by acquiring repetitive T1-weighted images of the tissue-of-interest after a bolus injection of an MRI contrast agent. As the MRI signal is proportional to the contrast agent concentration, the signal intensity-time curves can be used to compute tissue permeability and/or perfusion. Hence DCE-MRI is also sometimes referred to as perfusion weighted imaging.

Head and neck cancers are often treated with induction or concurrent chemo-radiation therapy. One of the major factors affecting chemo/radiation response is adequate blood flow to the tumor as it aids in drug delivery for chemo sensitivity as well as adequate oxygen availability for radiation sensitivity. Thus non-invasive assessment of tumor perfusion by DCE-MRI can play an important role in the prognosis and treatment monitoring of Head and Neck cancers. However, optimization of DCE-MRI methods of data acquisition and analysis is important to establish it as a robust method for detecting response to treatment. This presentation will outline data acquisition, processing and analysis methods for DCE-MRI, especially for Head and Neck cancer. We will describe the methods for achieving high temporal and spatial resolution DCE-MRI data as well as motion correction algorithms, which are necessary for accurately delineating vascular flow parameters and measurement of arterial input function.

Kinetic modeling of the DCE-MRI data is complicated and is dependent on the way the data is acquired and analyzed. In this presentation, we will describe the various heuristic and quantitative DCE-MRI parameters that can be obtained from DCE-MRI, including the rate constant of the contrast agent from the vasculature to the endothelium (K_{trans}) and the extravascular extra-cellular space (v_e). We will describe the physiological relevance of these parameters in the clinical setting. Studies correlating DCE-MRI with tumor metabolism and hypoxia will also be discussed. We will describe the advantages and limitations of the various analytical methods used in DCE-MRI of head and neck cancer.

Applications of pre-treatment DCE-MRI as a diagnostic and prognostic marker in head and neck cancer will be described using the data from the metastatic neck node as well as the primary base-of-tongue tumor. The use of K_{trans} and K_ep as potential imaging biomarkers for assessing treatment response to radiation therapy will be discussed. Post therapeutic changes in blood flow/permeability depend on the type of treatment and the time of MRI during or after completion of a particular therapy. We will discuss the various scenarios in which the direction of the change in K_{trans} from baseline could differ depending on the therapy used. In summary, this presentation will provide the audience with an overview of the advantages and limitations of DCE MRI in prognosis and monitoring treatment response in Head and Neck cancer.