

AbstractID: 12022 Title: Strengths and Limitations of Anatomical and Spectroscopic MRI in Radiation Oncology Treatment Planning

Magnetic resonance imaging (MRI) is playing an increasingly important role in radiation oncology treatment planning. As compared to computed tomography (CT), MRI provides excellent soft tissue contrast making it ideal for imaging brain tumors. Other anatomical sites (e.g., prostate, pelvis, head and neck, extremities, abdomen, etc.) also benefit from the soft tissue contrast provided by MRI, but are limited by difficulties in reproducing CT patient positioning in the MRI as well as geometric distortions introduced within the MRI datasets. These issues will be described, along with techniques for their minimization and quantification. MRI is also a powerful and non-invasive imaging modality to assess tissue motion, caused by a host of physiological processes (respiration, peristalsis, bladder and/or rectal filling, etc.). Clinical approaches to using MRI for motion management will be described.

In addition to morphological imaging, magnetic resonance spectroscopic imaging (MRSI) provides a non-invasive spatial mapping of abnormal tumor metabolism. This information may provide critically relevant assessment of the presence and extent of tumor activity, which may be substantially different from those considered to contain tumor based on T1 and T2 imaging. Many uncertainties remain: geometric and quantification accuracy of the acquired MRSI data due to magnetic field imperfections, lack of adequate anatomical details with MRSI images for registration with planning CT, and lacking essential DICOM objects hamper the incorporation of MRSI information into the treatment planning process. Clinical approaches to using MRSI for tumor target delineation will also be described.

This lecture will outline the indications for MRI in radiation oncology treatment planning for both external beam and brachytherapy. Examples are provided for many anatomical sites, along registration of MRI datasets with PET/CT. Approaches that can be used to validate MRI applications will be provided, along with a description of the current limitations.

Learning Objectives:

1. Widespread applications of MRI in radiation oncology treatment planning
2. Assessment of geometric distortion when MRI is utilized as one of several imaging modalities: reproducibility of patient setup and image distortion
3. Application of MRI to quantify and validate motion management models
4. Review obstacles to clinical utilization of magnetic resonance spectroscopic imaging (MRSI)

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