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# 13th Meeting of the MR-linac Consortium Proceedings - Background

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## Abstract

MR-Guided Radiotherapy Background

Image guided radiation therapy (IGRT) has become ubiquitous and an essential tool in the reduction of radiation treatment delivery uncertainty. The goal has been to aid radiation therapy targeting in order to more confidently and conformally deliver dose to tumors and improve tumor control, while minimizing the dose to normal organs at risk (OARs) to reduce toxicity. Use of Cone Beam CT (CBCT) based image guidance is now commonplace, and data demonstrating improved patient outcomes for diseases such as prostate cancer, lung cancer, and sarcoma have been published. Clinical justification and rationale for use of IGRT are summarized in an excellent review by Bujold et al [2].

Use of MR-guided radiation therapy offers a number of advantages over CBCT-based image guidance [3]. Fundamental to these advantages is the ability to visualize soft tissues with high fidelity before and during actual radiotherapy delivery. Among other things, this decreases the positional uncertainty of targets (e.g. CTV) and organs at risk. Such uncertainty, may in part, be accommodated by applying planning target volume (PTV) margins that account for the positional uncertainty of these structures, which in turn may lead to unnecessary toxicity and may limit the ability to escalate dose necessary to obliterate tumor. High quality and real time MR imaging of soft tissue addresses this problem by allowing for smaller and more dynamic PTV margin development, and thus the potential to both reduce toxicity and escalate dose. The ability to directly visualize leads to opportunities to adapt to target positional changes and shape changes not previously available. Other opportunities such as with the use of functional MR imaging (fMRI) may provide addition dimensions to the adaptation paradigm including biologic adaptation and the potential to modulate treatment based on fMRI. Research and development of these MRgRT opportunities has been the major focus of the Consortium.

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