

AbstractID: 4401 Title: Potential and Challenges of Integrated Brachytherapy-IMRT Planning

Combinations of external-beam radiation therapy (EB) and brachytherapy (BT) and have been used for many years. Conventionally, the EB and BT components are planned independently and limited to combinations of doses and dose-time-fractionation patterns that have been directly validated by clinical outcome studies. Ongoing research in radiobiological modeling, deformable image registration, and quantification of dose delivery uncertainties has the potential to provide the scientific foundation for truly integrated EB-BT planning that could significantly improve clinical outcomes. First, the complementary strengths and weaknesses of BT and highly conformal EB methods, such as intensity-modulated radiation therapy (IMRT), will be reviewed. Both IMRT and BT can support high dose conformality. IMRT can treat large surgically inaccessible target volumes with relatively homogeneous dose distributions. Where BT can be surgically realized, large dose fractions can be delivered with much higher geometric precision than with current IMRT delivery techniques. Next, clinical settings where integrated BT-IMRT can have benefit will be reviewed. One example is definitive treatment of cervical cancer in which IMRT is used to compensate for primary tumor underdosing or normal tissue overdosing by the intracavitary BT insertions as well as for conformal treatment of the pelvic lymph nodes. Finally, the scientific and clinical challenges to integrated BT-IMRT will be reviewed. For example, in high dose-rate (HDR) interstitial BT of the prostate combined with IMRT whole pelvic irradiation for intermediate risk disease, a major source of dose-delivery uncertainty is the conversion from physical-to-isoeffective dose needed to account for differences in fractionation.