

MRI Guided, Conformal Brachytherapy for Cervical Cancer

A patterns-of-care study confirmed brachytherapy (BT) remains the cornerstone of radiotherapy for cervical cancer. However, BT has relatively unchanged for many years: prescribing radiation dose to Point A, regardless of the tumor characteristics or the individual patient anatomy. Utilizing magnetic resonance imaging (MRI) for BT is currently gaining momentum. It allows clinicians to deliver radiation adaptive to macroscopic tumor volume and regression. This overcomes the limitations of 2-D orthogonal radiographs and even computed tomography (CT).

The conventional Manchester system (Point-A) based BT would be reviewed in terms of its advantages and disadvantages over 3-D imaging based BT. The current status of 3-D imaging based BT in North America would be reviewed and the challenges of CT-based BT are discussed. The MRI-guided, conformal BT is defined as the isodose lines of treatment plan is conformally optimized to tumor and OAR based upon MRI datasets. The 2% of institutions in US was reported to use MRI as a treatment planning modality. The clinical and physics / technique oriented challenges of MRI-guided BT are discussed. The clinical challenges have been the lack of logistics, e.g. workflow, and experience, especially of contouring. The physics / technique oriented challenges are summarized to three folds; source-pathway reconstruction, localization of an applicator, i.e. patient's movement between HDR room and MR scanning room, and volume-based planning logistics. Conventional Manchester system based HDR plans are retrospectively evaluated using the dose-volume criteria of GEC-ESTRO recommendations, providing the understanding of the correlation of Point-A doses versus D90 of HR (high risk)-CTV and ICRU rectum / bladder doses versus their D2cc. When using current intracavitary applicators such as tandem-and-ovoids or tandem-and-ring, the potential limitations of MRI-guided BT for large tumors are discussed. There are mainly three approaches for large tumors; interstitial BT, the use of new intracavitary plus interstitial applicators, and intensity-modulated BT.

Learning Objectives:

1. Understand the limitations of Point-A based brachytherapy
2. Understand the benefits of MRI-guided, conformal brachytherapy
3. Understand current challenges of MRI-guided, conformal brachytherapy