

Implementing MR-Guided Adaptive Brachytherapy for Cervical Cancer

Image-guidance plays an important role in modern radiation therapy, predominantly in external beam planning and delivery. In recent years, however, with the advent of high/pulsed dose rate (HDR/PDR) afterloading technology, advanced treatment planning systems and CT and MRI compatible applicators, image-guided adaptive brachytherapy treatments (IGABT) are now achievable. With image guidance, the target can be delineated more precisely, resulting in delivering more controlled doses of radiation to the target while sparing surrounding healthy tissue.

The whole process requires a committed team of physicians, physicists, nurses, with clear roles and infrastructure needs that will be explained clearly. We are proposing to describe the complex processes of implementing a new IGABT program, drawing from our own group's experience in the Department of Radiation Oncology, Duke University Medical Center.

GEC-ESTRO guidelines, crucial for implementing robust and standardized IGART, will be reviewed. They rely on MRI-guided planning for cervical cancer. MRI can be performed for each BT fraction to adaptively plan and deliver the desired radiation dose with less toxicity to surrounding tissues. MR imaging has its advantages, but also challenges and limitations (image artifacts and distortion related to magnetic nonlinearity, MR sequence selection, accuracy of 3D applicator reconstruction) that need addressed. Treatment planning flow will be discussed for different scenarios: when both CT and MR images are available vs. MR alone, when solid applicator applicators are available vs. not. Different treatment planning techniques will be presented. Advantages and limitations of our proposed flow will be also addressed.

Learning Objectives:

1. Understand the benefits of IGARBT in general, MR-based in particular. Understand the GEC-ESTRO guidelines and resources needed to implement IGARBT based on GEC-ESTRO. Identify the infrastructure and personnel needed for successful implementation of IGARBT. (J. Chino)
2. Learn about the MR imaging sequences needed to image soft tissue and applicators, respectively. Understand the process of applicator reconstruction with and without the use of solid applicators library. (J Cai)
3. Understanding the treatment planning flow: image registration, planning techniques, data reporting, dose summation of brachytherapy fractions and with external beam. (O. Craciunescu)
4. Understand potential challenges and barriers in implementing MR-based IGARBT: Convenient access to MR, time constraints, physician and physicist expertise with MRI, lack of CT/MRI compatible applicators, MR alone planning vs. MR/CT-based planning. (O. Craciunescu)

Possible Lead Speakers or Moderators (*Limit to 3 or 4; AAPM members preferred, where feasible; please indicate whether person is an AAPM member or non-member and include contact information for non-members.*)

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