AbstractID: 2608 Title: Clinical Implementation of IMRT for Lung Cancers

IMRT has not been widely accepted as a standard-of-practice for treating lung cancers because of concerns of organ motion and that IMRT may spread large volume of low dose to radiosensitive lung tissue. At our institution, IMRT has been used mainly in the management of superior sulcus tumors, mesotheliomas, challenging non-small-cell and small-cell lung cancers, and retreatment situations. To be able to use IMRT effectively for lung cancers, we need to pay attention to the following specific issues unique to this site. Patient Selection: IMRT may benefit patients who have critical organs adjacent to target volumes, e.g. spinal cord, esophagus, and previously irradiated tissues. IMRT can also be a superior tool compared to 3DCRT in providing dose coverage of complex shaped tumors such as multiple primary lesions and lymph nodes, and sculpturing dose away from normal lung. Target and motion: GTV for lung cancers should ideally be defined using multimodality imaging combining CT, PET, and MRI (if involving spinal cord and other soft tissues). CTV margin should consider probability of tumor seeding outside GTV and histology of different diseases. ITV margin should ideally be defined using dynamic 4D imaging to account for patient and tumor specific internal motion mainly from respiration. For highly mobile tumors, breath-hold or other motion mitigation techniques may need to be implemented for IMRT delivered with dMLC. PTV margin needs to be examined and defined based on specific patient setup techniques with the help of portal or on-line imaging. Accurate and reliable patient setup and immobilization are critical to IMRT as any other sites. Inverse planning: The most radiosensitive thoracic structure is lung, which may be affected by even low doses and often competes with target volume in terms of planning objectives. Shaping low doses away from lung is an important priority for lung and unique to IMRT of lung cancers. Providing adequate coverage with sufficient homogeneity to target volume is another important goal in planning. Sparing critical organs, i.e., cord, esophagus, heart, and reducing hot spots in non-specific normal tissues should also be included as planning goals. The number of beams and their angles should be optimized carefully with the goals of sparing lung and critical organs, meanwhile considering delivery efficiency and patient compliance. Use of many equally spaced beams (>7) should be rarely used. Dose delivery and QA: IMRT delivery with dMLC should consider optimizing leaf sequence and improving MU efficiency. MLC transmission and leakage can contribute significant dose to lung and normal tissues for IMRT plans with many segments and high degree of modulation. Dosimetry verification should be performed for each treatment planning system, which is often limited in the degree of dose accuracy and is likely to underestimate low-doses for lung IMRT. Monte Carlo based systems can be used complementary to measurements for commissioning and dosimetry QA purposes.

Educational Objectives:

1. To understand physics processes involved in using IMRT for lung cancers;
2. To understand specific requirements and unique aspects of implementing IMRT for lung cancers.