Multileaf Collimator Dosimetry

Multileaf collimators (MLC's) offer a state-of-the-art method for field shaping in radiation therapy. The most imporant advantage of this technology lies in its potential for use in the delivery of three-dimensional conformal therapy and intensity-modulated radiation therapy. One issue that discouraged some clinicians from accepting MLC more readily is the "zigzag" approximation to the shape of the target volume with MLC compared with the smooth conformation using shaped blocks. Several recently published papers show that there is negligible difference in the dose dose distributions when customized smooth field shaping and MLC are compared for the same target volume treated with more than one field. Important dosimetric characteristics of an MLC system are field-size dependence of output factors, depth doses, isodose distribution, penumbra and leaf transmission data. Depth dose curves and isodose distribution are minimally affected by MLC system. The penumbra and leaf transmission are important for modeling field edges and dose outside the field. The dosimetric parameter that has the most profound effect on the accuracy of dose delivered with MLC is the change in output factor with field shaping. Three major contributors of scatter radiation to the in-air output are the flattening filter, beam modifier, and tertiary collimator. Several methods have been proposed in the literature which describe the scatter photon energy fluence distribution emanating from the treatment head. These model based approaches require sophisticated programming and/or complex experimental measurements. Generalized approach for accurately calculating output factor for arbitrary shaped fields and the dosimetric parameters that impact the use of MLC as an intensity modulation device will be discussed in this lecture.

Educational Objectives:

1. Understanding the dosimetric characteristics of multileaf collimators

2. Understanding the dosimetric parameters to commission MLC for treatment planning

3. Understanding dosimetric parameters for intensity modulated radiation therapy with MLC