AbstractID: 7216 Title: IMRT with Multileaf Collimators

Intensity modulated radiotherapy (IMRT) using conventional multileaf collimators (MLCs) has gained much attention in the radiation therapy community. This type of radiotherapy uses simple or complex variations of intensity across defined fields to yield additional degrees of freedom and more conformal distributions that can simultaneously deliver tolerable doses to defined sensitive normal tissues and lethal doses to defined tumors.

Simple IMRT can be planned with conventional 3DCRT treatment planning systems using iterative optimization. A conceptual example of a simple IMRT beam is one made up of 2 segments, one of which treats the entire projection of the target with normal margins and a second which treats only that portion of the target that is not shadowed by a sensitive normal tissue. This type of simple IMRT method is described in the literature and is in routine use in some facilities. Recent publications show that simple IMRT can be very useful as a replacement for compensators, as a means of improving dose uniformity or performing concomitant boosts.

General IMRT is used for complex treatment geometries that require the use of inverse treatment planning programs with computerized optimization. The planner defines the desired doses to target and specified normal tissues, the number of beams, their directions and the maximum allowed complexity of the intensity pattern and the program returns with intensity distributions for each beam that will approximate the desired dose distribution. A delivery method is then selected that can reproduce that intensity pattern.

To implement IMRT safely and efficiently, it is essential to understand the characteristics of MLCs, the associated delivery systems, and the limitations of each system when applied to IMRT. In this presentation, the characteristics of various MLC collimators will be described, including the location of the MLC, whether or not it is single or double focused, the physical characteristics of leaves, the leaf movement restrictions, and the maximum achievable field size for IMRT delivery. MLC-based static and dynamic mechanisms are reviewed, and the delivery systems

for these collimator systems are described. Machine-related and patient plan-related quality assurance issues will also be discussed.

Educational objectives:

1. To understand the definitions of IMRT
2. To understand the various designs of MLCs used by linac manufacturers
3. To understand the impact of various designs on IMRT planning and delivery
4. To understand the roles of forward- and inverse-planned IMRT in radiotherapy
5. To understand the limitations of different MLC delivery schemes
6. To understand the quality assurance issues surrounding IMRT