AbstractID: 4441 Title: IMRT Patient QA

Intensity modulated radiation therapy (*IMRT*) has become the standard-of-care for most cancer treatment programs. According to the 2004 AAPM professional information survey, 87 percent of the respondents had IMRT on one or more therapy units at their institution. The clinical successful or failure of an IMRT treatment program is dependant on the correct delivery of the 3D dose distributions calculated by the planning system (*Planned Dose*) to the correct location in the patient (*Delivered Dose*). There are many sources of error that can arise during IMRT planning and delivery. However, it is ultimately the responsibility of the Medical Physicist to ensure that the Planned Dose "agrees" with the Delivered Dose. The difference between Planned Dose and Delivered Dose (*i.e. Error*) in IMRT can originate from at least three different sources: 1.) The treatment planning model, 2.) Treatment delivery dosimetry and mechanics, and 3.) Time-dependant target/tissue positioning.

The IMRT treatment planning model must be evaluated as part of the initial IMRT commissioning, and again after major software upgrades. The IMRT model evaluation can be performed using geometric test plans, anthropomorphic phantom test plans, and patient test plans. Calculated and measured absolute and relative doses should be compared using multiple measurement techniques, such as film, ionization chambers, TLDs, diodes, electronic imaging devices, etc. The test plans and techniques should be similar to those that will be used in clinical practice.

The multileaf collimator and the linear accelerator must be evaluated for dosimetric and mechanical accuracy. IMRT test sequences can be used to evaluate leaf positional accuracy, time-dependant leaf positioning, motor performance, and dosimetry. These tests can be performed using film, ionization chambers, TLDs, diodes, electronic imaging devices, etc. In addition, patient-specific IMRT quality assurance should be performed for each patient to verify that the planned and delivered doses are within tolerance.

An additional source of error in IMRT is the uncertainty in the position and shape of the target volume. The use of image-guided radiation therapy can help minimize, but will not eliminate these errors. The impact of intra-fraction motion on IMRT delivery can be measured using a dynamic motion phantom to simulate clinical conditions. Film, ionization chambers, TLDs, or diode dosimeters can be placed in the dynamic phantom to directly measure the impact of motion on IMRT dosimetry.

This continuing education course will discuss commercially available dose measurement tools, phantoms, and techniques for performing acceptance testing, commissioning, and routine quality assurance for the IMRT process. The three classes of error will be discussed, with a special emphasis on the lessons learned and manpower requirements.

Educational Objectives:

1. To understand the issues surrounding IMRT quality assurance
2. To identify potential sources of errors in IMRT quality assurance
3. To review the tools used in IMRT quality assurance
3. To understand the impact of target localization and patient positioning on IMRT