AbstractID: 9807 Title: Clinical pitfalls and limitations of IMRT

IMRT is a new approach to radiation therapy, and many of the tools and techniques are still in an early stage of development. As a result there are a number of potential problems and limitations that can affect its clinical use. The purpose of this talk is to highlight some of these issues and, where possible, to suggest methods to prevent them or quality assurance steps to identify them. One set of issues relates to dosimetric accuracy and includes penumbra representation, MLC transmission, small field dosimetry, and inhomogeneity corrections.

Another set of issues relates to inverse planning and the requirement that the user specify the problem (e.g. structures and goals) instead of a solution (e.g. beams and weights). Much that is implicit in conventional planning needs to be made explicit for inverse planning so that targets and normal tissues are treated appropriately. Areas of concern include delineating targets and normal structures, defining realistic margins, dealing with the buildup region, and choosing beam directions. Examples will be shown of plans that were "optimal" according to the inverse planner but were clinically unacceptable. Learning how to steer the optimizer toward better plans, evaluating plans, and knowing if and how a proposed plan might be improved are all challenging with IMRT, and methods for developing those skills will be suggested.

With IMRT, targets may be treated at nonstandard daily doses and with substantial dose variation; these facts have radiobiological consequences that need to be considered.

The conversion of intensity maps into deliverable leaf sequences creates a number of possible pitfalls. Some planning systems handle MLC mechanical constraints incompletely and create sequences that are not deliverable or that have other deficiencies that can compromise patient treatments.

The quality assurance of IMRT plans creates another set of challenges. Measuring dose distributions in a phantom for patient plans that have been recalculated for the phantom is better suited to discovering delivery errors than planning errors. The dose to the phantom is not expected to be the same as to the patient, and examples will be given of errors that would not be caught by such measurements. An independent calculation can find planning errors, but not delivery errors, and may not catch information transfer errors if the calculation uses files from the planning system instead of the treatment delivery system.

Verification of patient setup and the proper orientation of intensity modulated fields are also of concern. Portal images need to be compared to high quality DRRs produced by the system that produced the plan in order to verify that the patient model and isocenter in the plan match reality.

Objectives

To identify potential problems with clinical use of IMRT, related to:

1. dosimetric accuracy of characteristics such as MLC penumbra and transmission,
2. defining the clinical goals to the inverse planning system,
3. evaluating and steering the plans produced by the inverse planning system, and
4. creating a robust quality assurance system.