Dosimetric Aspects of Intensity Modulation in Serial Tomotherapy

Because of its unique characteristics, intensity modulated serial tomotherapy has special dosimetric concerns, such as radiation leakage, scattering at different depths and between treatment slices and dose inhomogeneity in the abutment regions. Three series of plans were created to systematically examine several of these issues for an early version of the PeacockPlan system and a later version of the CORVUS system (NOMOS). To investigate radiation leakage and scattering from neighboring treatment slices, a series of plans was designed with targets of varying dimensions, requiring different number of couch indices, and different numbers of intensity profiles. To evaluate the scattering model at different depths, a second series of plans was designed with the target at different depths. To study the dose inhomogeneity in the abutment region away from the iso-center, a third series of plans was designed with targets at different distances from the iso-center. Verification measurements for these plans were conducted using ionization chamber and film dosimetry. The measurement results showed that the radiation leakage and scattering from neighboring treatment slices were modeled more accurately in the CORVUS system than in the PeacockPlan system. In both systems, doses predicted for the target at different depths were in excellent agreement with the measured results. For a 270^0 arc delivery, if the location of the target is within ± 5.0 cm of the iso-center, the additional dose non-uniformity due to uncompensated beam divergence, is insignificant.

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