

AbstractID: 7304 Title: Simulation of neutron dose exposure for pediatric proton therapy patients using whole-body age-dependent voxel phantoms

Purpose: With the average age of radiation therapy patients decreasing due to early cancer detection and a larger proportion of patients being cured and thus at risk for treatment complications, there has to be a growing concern for the risk of developing cancer due to radiation treatments, in particular for pediatric and young patients. Age and gender specific whole-body phantoms have been implemented in Geant4 in order to determine the dose from secondary radiation in patients undergoing proton treatment.

Method and Materials: In a systematic study, we have used three methods to calculate the neutron organ equivalent dose to 14 organs distal to the target volume for six circular fields of varying diameters and range/modulation width combinations and for two patient fields that were previously used to treat two pediatric patients at the F. H. Burr Proton Therapy Center of Massachusetts General Hospital for brain lesions. Results using an adult phantom as well as phantoms of a 9-month old male, a 4-year old female, an 8-year old female, an 11-year old male and a 14-year old male were analyzed.

Results: The relative contribution to organ dose from secondary radiation from the treatment head and secondary radiation generated within the patient was evaluated. We found that the organ equivalent dose has a marked dependence on the phantom age, the distance between the organ and the PTV as well as on field characteristics. Overall, the organ equivalent doses were below 3 mSv per treatment Gy.

Conclusions: The organ equivalent neutron dose for proton treatments of brain lesions in organs distal to the target was calculated for six age-dependent phantoms. We found that the dose decreases with patient age and also depends on field size, beam energy and modulation.

Work supported by NIH/NCI RO1 CA 116743