AbstractID: 5460 Title: Estimating Differences in Volumetric Bone Growth by Treatment Method

Purpose: To estimate potential differences in volumetric bone growth in children with sarcoma treated with intensity-modulated (IMRT) and conformal (CRT) radiation therapy using an empiric dose-effect model.

Methods: Volumetric bone growth was estimated 4 years after radiation therapy for 36 pelvic bones (ischio-pubis and ilium) from 11 patients using a random coefficient model for flat bone growth that incorporated patients age, pre-RT bone volume, integral bone dose >35Gy, and time after completion of RT. Dosimetry representing the actual CRT/IMRT plan, a non-treated comparable IMRT/CRT plan and an idealized plan delivering dose only to the PTV, with no dose delivered to tissue outside the PTV, were entered into the model and the resultant volumes compared relative to modeled normal bone growth (integral dose of zero). The prescribed dose to the PTV ranged from 36-55.8 Gy and the median values for the PTV and studied bone volumes were 774 ml (147-1964 ml) and 76 ml (14-215 ml), respectively.

Results: Relative to normal bone growth, patients were predicted to maintain 93%, 87% and 84% ($p=0.06$) of their expected growth with idealized, IMRT and CRT approaches, respectively. Older patients, age $\geq$10 years were predicted to maintain a mean growth of 98% compared to normal regardless of method. Those age < 10 years maintained 87% (idealized), 76% (IMRT) and 70% (CRT) of expected growth ($p=0.015$). On post hoc testing (Tukey) CRT and IMRT both differed significantly from idealized but not from one another.

Conclusions: Linear dose-effect models facilitate comparison of treatment methods and potentially interventions. For older patients, treatment methods do not significantly impact growth for specific flat bones; however, for younger patients, treatment methods may significantly impact flat bone growth especially as we move towards idealized dose distributions potentially feasible with particle therapy.