AbstractID: 11540 Title: Investigating Effects of Pelvic Bone Marrow Radiation Dose on Acute Hematologic Toxicity using High Dimensional Data Analysis

Purpose: To develop a new method to investigate the effect of local pelvic bone marrow (BM) radiation dose on acute hematologic toxicity (HT) in cervical cancer patients undergoing concurrent chemoradiation therapy (CRT), with the ultimate goal of optimizing BM-sparing radiation techniques.

Method and Materials: We analyzed 24 cervical cancer patients treated with concurrent cisplatin (40mg/m^2/week) and pelvic IMRT. The white blood cell count (WBC) nadir, defined as the lowest value occurring between the start of CRT and two weeks following IMRT, was used as the indicator of acute HT. The pelvic bone region included the os coxae, lower lumbar vertebrae, sacrum, acetabulae, and proximal femora. BM doses were standardized in two steps: pelvic bone registration followed by dose remapping. Simulation CT images were registered to a common (canonical) template using the optical flow based deformable image registration developed by Yang et al.[2]. The deformation field was used to remap the dose distribution back to the deformed pelvic bones. We generated a data structure called a "dose-array" that reserves the spatial information of each dose value. The position of an element inside array can be used to trace its location in 3D.

Results: Substantial variation of BM dose distribution among the 24 patients was observed. Patients were classified based on their WBC nadir value ($\geq$ vs. $< 2000/\mu L$) into two groups (n=15 vs. n=9, respectively), and the average pelvic BM 3-D dose distribution was compared visually. Results suggested that patients receiving higher doses to the lower lumbar spine, upper sacrum, and medial ilium, were more likely to develop acute HT

Conclusion: We have developed a novel method to study the impact of BM radiation dose on acute HT. Our next step is to implement both unsupervised and supervised classification models to analyze radiation effects, for use in IMRT plan optimization.