AbstractID: 13499 Title: Image-guided extended-field radiation therapy for functional bone marrow sparing in cervical cancer patients with positive para-aortic lymphnodes

Purpose: To assess the feasibility of image guided radiation therapy to reduce functional bone marrow (FBM) dose for cervical cancer patients with positive para-aortic lymph nodes undergoing extended field intensity modulated radiotherapy (EF-IMRT).

Method and Materials: Three patients were enrolled on a prospective study to test image-guided FBM-sparing EF-IMRT (IG-EF-IMRT). Patients underwent CT simulation plus (1) whole body ^{18}F-FDG-PET and (2) quantitative MRI using iterative decomposition of water and fat with echo asymmetry and least-squares estimation (MRI-IDEAL). Regions of high standardized uptake value (SUV) (increased glucose metabolism) on PET and low fat fraction (high cellularity) on MRI-IDEAL indicated higher FBM concentrations. The PET and MRI-IDEAL were registered with the simulation CT. FBM was segmented based on the patient's individual mean SUV and fat fraction within lumbosacral spine and pelvis. For each patient, 2 plans were compared: non-IG-EF-IMRT(CT defined BM as the sparing objective) vs. IG-EF-IMRT(FBM as the sparing objective).

Results: The mean FBM volume, as a proportion of lumbosacral spine and pelvis, was 23% (s.d. 0.6%). IG-EF-IMRT significantly reduced the volume of FBM receiving $\geq$ 10 Gy and $\geq$ 20 Gy (V10 and V20) compared to non-IG-EF-IMRT. With PET and MRI-IDEAL guidance, the mean FBM V10 was reduced from 94% to 89%, mean FBM V20 was reduced from 86% to 73%. IG-IMRT plans did not compromise target coverage or increase dose to normal organs. One patient was treated with IG-EF-IMRT, with FBM V10 and V20 of 82% and 70%, respectively. She received all 5 cycles of weekly cisplatin (40 mg/m^2) and had grade 2 HT during CRT. The other two patients were treated with non-IG-EF-IMRT and planned with IG-EF-IMRT.

Conclusion: IGRT for FBM sparing is clinically feasible and significantly reduces FBM dose compared to standard IMRT. This novel technique may reduce HT and is being tested in a clinical trial.