

AbstractID: 6568 Title: Feasibility Study of Linac-Based Intensity Modulated Total Marrow Irradiation (IM-TMI)

Purpose: Standard total body irradiation (TBI) techniques are associated with both acute and chronic toxicities due to the large volume of normal tissue irradiated. Additionally, inhomogeneous dose distributions are known to be the cause of failures and relapses in the treatment of leukemia and lymphoma. The goal of this study is to investigate the feasibility of linac-based intensity modulated total marrow irradiation (IM-TMI) and to discuss the challenges associated with its clinical implementation.

Methods: To evaluate the feasibility of linac-based IM-TMI, we performed an exploratory treatment planning using the CT scan of a TBI patient. Active bone marrow sites were defined and contoured as the clinical target volume (CTV) and a margin was added to create the planning target volume (PTV). Dose limiting organs included the lenses, lungs, liver, kidneys, and heart. IMRT plans were created using the Eclipse/Helios inverse planning system (Varian Inc., Palos Alto, CA) to deliver a total dose of 12 Gy. Dose volume histograms (DVHs) were calculated and subsequently compared with standard TBI-DVHs.

Results: IM-TMI resulted in a significant reduction in the volume of normal tissue irradiated compared with conventional TBI. The median lung doses were 7.3 Gy and 8.8 Gy, while the maximum lung doses were 12.9 Gy and 15.5 Gy for IM-TMI and conventional TBI, respectively. The maximum dose to the lenses was 7 fold less using the IM-TMI approach. Similar results were also observed for liver, kidney, heart, small bowel, and spleen. Moreover, IM-TMI resulted in a more homogeneous dose to the PTV with a median dose of 12.3 Gy vs. 10.5 Gy using standard TBI.

Conclusions: Our results demonstrate that linac-based IM-TMI is capable of delivering a conformal dose to the target volume while reducing the dose to the surrounding normal tissue. Such an approach may improve the overall efficacy of TBI.