Purpose: To investigate the dosimetric feasibility of VMAT-TMI technique in terms of treatment planning and delivery efficiency and accuracy for a Rando phantom using Eclipse RapidArc technology.
Methods: Total body irradiation (TBI) has been an integral part of pre-conditioning regimens for the treatment of hematologic malignancies. Normal tissue toxicity is a common complication of TBI inclusive regimens especially at doses higher than 12 Gy due to inhomogeneous and excessive dose to organs at risk (OARs). Fixed gantry linear accelerator (linac) and Tomotherapy intensity modulated total bone marrow (IM-TMI) techniques have been reported to reduce doses to OARs. However, the treatment time of more than one hour with both techniques may limit their clinical application. Volumetric modulated arc therapy (VMAT) may be able to increase the treatment delivery efficiency while increasing the target conformality and reducing the radiation dose to OARs. In order to treat all the bones in the Rando phantom, three sub-plans with a total of nine arcs were used. A total of 100 thermoluminescent detectors (TLDs) were placed at 39 positions throughout the phantom. The measured TLD doses were compared to the calculated plan doses. Planar dose for each arc was verified using MapCheck and MapPhan.
Results: Excellent target coverage with the prescription dose and dose reduction to the OARs were achieved similar to the fixed gantry linac IM-TMI technique. The number of monitor units was decreased by 50%, while the delivery efficiency increased by more than 60%. TLD readings demonstrated accurate dose delivery, with a median dose difference of 0.5% from the calculated dose. Planar dose distributions of all arcs satisfied the 3% and 3 mm gamma criteria with an average pass rate of 97.8%.
Conclusions: Results from this study suggest that RapidArc VMAT-TMI technique is clinically feasible.

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