Purpose: Total body irradiation (TBI) is commonly used for conditioning prior to transplant in hematologic and immunologic diseases. Due to variability in body thickness, achieving dose uniformity across body within ±10% of the prescribed dose is challenging. The dose uniformity is further complicated by, techniques and beam energy used, lung shielding and selection of detector. The translational table technique for TBI could compensate for estimated delivered dose to whole body by adjusting couch speed during treatment. However, it is difficult to accurately estimate the dose by calculation and hence in vivo dosimetry (IVD) is routinely performed for TBI. The patterns of patient specific dosimetry, IVD are presented in this study.

Methods: Under IRB exempt status, 161 patients who received TBI treatment between 2006 and 2011 were retrospectively analyzed using the treatment records from Cobalt-60 teletherapy unit and translational treatment couch. During treatment, IVD detectors (TLD, diode, or MOSFET) were placed on patient surface; both entrance and exit dose were recorded at the patient's head, neck, mediastinum, umbilicus, and knee. When large differences between prescribed and measured dose were observed, the dose delivery was corrected for subsequent fractions by adjustment in couch speed and/or bolus placement.

Results: Across the entire cohort, the mean (range) percent variance between calculated and measured dose were -2.3% (-66.2 - 35.3), 1.1% (-62.2 - 40.3), -1.9% (-66.4 - 46.6), -1.1% (-35.2 - 42.9), and 3.4% (-47.9 - 108.5) for head, neck, mediastinum, umbilicus, and knee, respectively. When the dose differences for multiple fractions were averaged, the compliance (±10%) between prescription and measured dose was improved as at umbilicus from 83.9% to 98.5%.

Conclusions: Actual dose measurement analysis of TBI patients reveals a potentially wide variance from calculated dose. Dose uniformity can be significantly improved with immediate feedback after the first fraction prior to subsequent treatments.

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