

Purpose:

Dose volume histogram (DVH) has been a valuable tool for plan evaluation, but it provides limited information for dose assessment of irradiated tumors and organs, especially for those with significant density heterogeneities such as lungs. DVH is also at odds with the fact that radiation dose is defined as energy deposited in a unit mass of medium irradiated. In this study, dose mass histograms (DMH) were used to evaluate plans from patients treated with stereotactic body radiotherapy (SBRT) and craniospinal axis irradiation (CSAI).

Methods:

Eight patients were enrolled in the study, of which four of them were treated with SBRT using a BrainLAB system and the other half were CSAI patients treated with a Helical TomoTherapy unit. DMHs for these patients were computed based on the treatment plan's DVHs by weighting each voxel volume according to its density as derived from the CT number vs. density table used in the treatment planning system. All eight plans were exported to a personal computer for DMH computation and analysis. Comparison between each patient's DVH and DMH for planning target volume (PTV) and organs at risk (OAR) were performed.

Results:

DMH was generated for the PTV and OARs. No significant difference between DMH and DVH was observed for PTV and OARs (heart, kidneys, spinal cord) except for lungs. Lung DMHs from SBRT patients indicated potential room of dose escalation while those from CSAI patients showed the opposite.

Conclusions:

Dose mass histogram serves as an important tool for evaluation of treatment plans for organs with variable densities. For organs with uniform density distribution, DMHs were not significantly different than DVHs. The potential usefulness of DMH for plan evaluation for organs of heterogeneous density distributions warrants further study.