

AbstractID: 3135 Title: Comparison of absorbed dose-to-medium and absorbed-dose-to-water for (head and neck and prostate) IMRT treatment plans

Purpose: Conventional photon dose calculation algorithms typically report the absorbed dose-to-water(D_{water}). Monte Carlo(MC) dose calculation algorithms, however, by default reports the absorbed dose-to-medium(D_{medium}). It has been suggested that for clinical comparisons, MC- D_{medium} results should be converted into D_{water} to ensure valid comparisons. The goal of this study is to assess if the difference between D_{water} and D_{medium} is clinically significant for MC calculated IMRT plans.

Method and Materials: Ten patients with H&N and ten patients with prostate cancer were selected for this study. Existing IMRT plans were re-calculated using an EGS4-based MC dose calculation system. D_{medium} was converted to D_{water} by multiplying D_{medium} results by average water-to-medium stopping power ratio. D_{water} and D_{medium} results for target and critical structures were evaluated using the DVH-based indices: D_2 (dose to 2% of the structure volume), D_{50} (dose to 50% of the structure volume), D_{98} (dose to 98% of the target volume), and D_{mean} (mean dose).

Results: For H&N, although the changes in average dose-volume indices were less than 1.5%, up to 6.2% differences in $PTV_{CTV} D_2$ were observed for individual patients. The cord and brainstem D_2 indices changed up to 2.5% and 2.7% respectively. For prostate, the differences in the indices for targets were less than 1%. The changes in critical structure indices were less than 1%, except for two patients in which changes up to 2.7% in rectum D_{50} index were observed. The increases in the range of 4.5- 11.5% in the femur dose-volume indices were observed in converting from D_{medium} to D_{water} due to the high calcium content of the hard bones.

Conclusion: This study showed that converting dose-to-medium to dose-to-water in MC-based IMRT plans may significantly change the structure doses for some cases, especially when hard bone containing structures such as the femurs are present.

Conflict of Interest (only if applicable): None