

AbstractID: 10648 Title: Can 4D Dose Be Constructed without Using Deformable Organ Registration?

Purpose: Image based deformable organ registration has been the primary means for 4D dose construction of moving organ. However, patient free breathing cone beam CT (FB-CBCT) is more routinely obtained, instead of 4D CBCT. In this study, we examine if FB-CBCT imaging can be directly applied for 4D dose construction.

Method and Materials: Organs with the mean shape obtained from 4D reference CTs were mapped on a FB-CBCT image by applying rigid-body matching. The 4D dose in the organ was then constructed on the mean CT image using the 3-dimensional-motion *pdf* detected by the CB projection images. Three lung cancer patients with a planning and multiple daily 4D CTs were used to evaluate this method. The daily FB-CBCT was constructed using the daily 4D CT. For each patient, dose distributions obtained from a 3D inverse planning and a 4D inverse planning were used in the evaluation. Dose distribution constructed using the mean organ and motion pdf was compared to the 4D dose calculated using the deformable organ registration on the daily 4D CTs. The minimal dose (D_{99}) and EUD for the target, and the maximum dose (D_1) for critical structures were used in the comparison.

Results: Dose discrepancy (the mean \pm SD) for D_{99} and EUD of the targets was $-0.6\% \pm 2.6\%$ and $0.0\% \pm 1.0\%$. Dose discrepancy of D_1 was $1.5\% \pm 1.5\%$ for heart, $-1.6\% \pm 3.3\%$ for Aorta and $-0.6\% \pm 3.7\%$ for Esophagus. Dose discrepancy in the lung was not evaluated in the current study due to the need of using variable pdfs at different location of the lung.

Conclusion: 4D dose in organs of interest could be directly constructed using daily FB-CBCT and measured pdf. The construction accuracy seems acceptable for the organs of interest inside of the lung.

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