

AbstractID: 13908 Title: The effect of change in target volume and tissue heterogeneity on dose distributions during the course of treatment with intensity modulated proton radiotherapy.

Purpose: To investigate the changes in dose distribution due to changes in tissue heterogeneity during the course of treatment with intensity modulated proton radiotherapy (IMPT).

Method and materials: A retrospective study was conducted using CT images acquired from daily CT-guided IMRT treatments for cancer of paranasal sinus. IMPT planning from the Eclipse treatment planning system (Varian Medical Systems) was used to design and calculate the dose distribution and to evaluate the dose volume histograms of GTV, CTV, PTV, and OAR for the first and consecutive daily CT images acquired on a CT-on-rails system. Two-beam optimization was performed on the acquired CT image for the first day of treatment. A verification plan was calculated on subsequent daily CT images by using the same beams' orientation with the same number of beam spots and fluence patterns as used for the first day.

Results: The reduction in volume from the first to last day of treatment for GTV, CTV, and PTV were 5%, 1%, and 1%, respectively. The volumetric coverage of GTV, CTV and PTV by 95% isodose line distribution were reduced by 13%, 6%, and 7%, respectively for the same period. The total dose received by 95% of the GTV, CTV, and PTV volume was reduced by 1.5%, 3%, and 5%, respectively. The maximum dose received by brainstem was actually reduced by 52%.

Conclusion: Small volumetric changes in tissue heterogeneity will have a diverse effect on tumor coverage for intensity modulated proton radiotherapy. The heterogeneity changes within the target volume affect the range of individual proton pencil beams that collectively optimize the tumor coverage.