

## AbstractID: 8398 Title: Decision Making in Daily or Weekly Volumetric Imaging Guidance Based on Case Studies

Objectives: Daily volumetric imaging provides accurate patient positioning at the cost of imaging dose and lengthened treatment time. In order to assess the necessity of these images for well immobilized head-and-neck cancer patients from a risk management point-of-view, magnitudes of set up errors corrected by TomoTherapy MVCT on a daily or weekly basis are analyzed. The impact of these errors on the delivered dose to the tumor and organs-at-risk (OAR) is calculated.

Methods and materials: the set up errors of 6 nasal cavity and 4 nasopharyngeal cancer patients were retrospectively analyzed. Each patient had MVCT guided daily repositioning. The new dose volume histogram (DVH) and equivalent uniform dose (EUD) for planning target volume (PTV) and OARs were calculated for hypothetical scenarios where no imaging guidance (IG) or weekly image guidance (WIG) took place.

Results: The mean total set up error if treated without daily IG was  $3.6 \pm 1.0$  mm, which can be reduced to  $1.7 \pm 0.6$  mm if a WIG was performed. The geometrical uncertainties from the absence of image guidance resulted in a reduction of mean PTV EUD dose by  $2.1 \pm 1.0\%$ , which can be reduced to  $1.4 \pm 1.0\%$  with WIG. The EUD of OARs increased  $1.8 \pm 2.0$ Gy or  $0.8 \pm 1.3$ Gy without or with WIG respectively. For the organ showing the most dosimetric impact from the image guidance, the probability of having 6 or 8 Gy of deviation was 10% and 2 % respectively. These probabilities were reduced by more than four fold if weekly IG was performed.

Conclusions: Without daily IG, the mean patient position uncertainty has relatively small impacts on the mean PTV and OAR dosimetry, which can be further reduced approximately by half using weekly IG. The frequency of the IG can therefore be determined by the deviation probability function of the most critical OAR and its limiting tolerance dose.