AbstractID: 10560 Title: Is daily image-guided patient positioning necessary for lung irradiation ?

Purpose: Image-guided radiotherapy (IGRT) delivers unwanted and un-negligible dose during the imaging process and requires additional resources. In this work, we determine whether it is necessary to use IGRT daily for lung irradiation.

Method and Materials: Image and couch shift data for 27 lung tumor patients treated with conventional fractionation schemes, using MV cone-beam CT (MVCBCT) for patient positioning, were analyzed. Among these patients, 13 (group I) received MVCBCT for each fraction (326 scans). The rest (group II, 14 patients) received MVCBCT for each fraction in the first and the last week of the treatment and only one scan per week in between (158 scans). Group II was treated when IGRT first became available and the variability in set-up was being assessed. All patients were immobilized with alpha cradle during planning CT simulation and treatment. MVCBCTs were registered with the planning CT based on bony anatomy alignment. The components of planning-target-volume (PTV) margin to account for set-up errors were calculated, using a four-parameter population margin recipe.

Results: Random errors along anterior-posterior (AP), left-right (LR) and superior-inferior (SI) were found to be 2.9 mm, 3.1 mm, 4.4 mm for group I and 2.5 mm, 3.1 mm, 3.9 mm for group II. Systematic errors along AP, LR and SI were 2.3 mm, 2.3 mm, 2.7 mm for group I and 1.9 mm, 1.8 mm, 3.9 mm for group II. The resulting PTV margins were 10.0 mm, 6.8 mm, 10.5 mm for group I and 6.2 mm, 6.9 mm, 10.5 mm for group II. The margin difference along AP was statistically significant ($p=0.003$).

Conclusion: The frequency of IGRT positioning depends on the PTV margin used. For lung irradiation using alpha cradle immobilization, an additional margin of 3 mm along the AP direction may be needed if IGRT repositioning is not used daily.