AbstractID: 10518 Title: Utilizing Radiobiological Measures and Planned Adaptive Software to Evaluate Adaptive Tomotherapy Plans for Lung Cancer Patients

Purpose: To evaluate the radiobiological effects of the adaptive tomotherapy using the biologically effective uniform dose (*BEUD*) in addition to physical dose indices assessed by the Planned Adaptive software.

Method and Materials: Three lung cancer patients who underwent helical tomotherapy were selected retrospectively. Daily megavoltage computed tomography (MVCT) scans were performed and registered with the planning kilovoltage CT (kVCT) images to correct the patient setup and internal organ motions. Evaluation on delivered dose in each treatment fraction of the tomotherapy was performed using the Planned Adaptive software. The cumulative dose difference between the planned total dose (i.e. fraction number x fraction dose) and the cumulative delivered dose was calculated. Among these three patients, one patient had two-phase tomotherapy plans. The two-phase tomotherapy of this patient contains the original plan and a second-phase plan, which is made because of the obvious tumor shrinkage in the target observed during the treatment course and concern about high cumulative dose to the ipsilateral lung. The second-phase tomotherapy plan of this patient could be deemed as an adaptive tomotherapy plan. Therefore, further investigation was performed to evaluate physical dose difference using DVH and incremental clinical effectiveness by the radiobiological index, *BEUD*.

Results: The dose ratio between the planned and the delivered doses for the tomotherapy plans remained consistent (varied within 1%) for two patients without adaptive tomotherapy. However, there was a considerable increase in the delivered dose ratio of the second-phase tomotherapy. Furthermore, significant rise in complication-free tumor control rate (P_+) of 15% in the second-phase tomotherapy plan indicates the clinical effectiveness of the adaptive tomotherapy.

Conclusion: The dosimetric impact and the clinical effect of the adaptive tomotherapy have been evaluated using the Planned Adaptive software plus the *BEUD*. The dosimetric effect of the adaptive tomotherapy planning was quantified into significant increase of P_+.