Abstract ID: 18688  Title: Integration of Lung Blocks in the Inverse Planning Process of Modulated Arc Total Body Irradiation Using Cone Beam CT

Purpose: The sizing and placement of lung blocks for total-body irradiation (TBI) is critical to prevent lung toxicities and maintain effective treatments. During modulated-arc TBI (MATBI) treatment, the patient is stationary near the floor while open-field beams with varying exposures are delivered. The inverse planning process currently aims for a uniform dose to the body, without accounting for the presence of lung blocks. This study investigates the possibility of including the effect of these blocks in the MATBI optimization process.

Methods: Dosimetric comparisons were performed using a water tank and a simple stack of solid water slabs. Lungs blocks made of cerrobend were fabricated and imaged using on-board megavoltage CBCT (MVCBCT). The reconstructed MVCBCT images were precisely registered with the reference CT for inverse planning. The cerrobend blocks were contoured in the planning system and the density was overridden to 9.3 g/cm³. Simulated doses in Pinnacle were compared to ion chamber, diode array and gaf-chromic film measurements obtained at 1.0, 5.0, 10.0 and 20.0 cm depths. Specific optimization objectives on the lungs were tested on 5 patients including a lung re-treatment.

Results: The maximum difference between ion chamber measurements and the treatment planning predictions was 2.4%. The measurements profiles with the diode array correlated reasonably well (<5%) with predictions. Gaf-chromic films demonstrated good accuracy at depth but large differences (>10%) on the surface. Lung blocks reconstructed with MVCBCT were structurally accurate without significant metal artifacts. A comparison of MATBI plans on patients shows that inclusion of lung blocks during optimization can reduce hot and cold areas in the lungs and the sternum.

Conclusion: Reasonable predictions of the lung block transmission can be obtained following the developed technique using megavoltage CBCT. Thus, lung blocks can be included in the MATBI inverse planning process, which can help prevent complications and local failure.