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Role of 4DCBCT in Lung SBRT

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Objectives: During the radiation treatment planning process, a 4-DCT is acquired to take into account respiratory motion, and used determine a patient specific ITV. In the past, there was no method to verify that the "planning ITV" provided adequate tumor coverage in all three dimensions during SBRT. Varian has recently released an advanced imaging feature which collects and reconstructs 4D CBCT data in the treatment position. In this work, we present our findings of this feature for clinical application.

Methods: Patients with stage I NSCLC, were treated under a clinical Lung SBRT protocol. Our IGRT workflow consists of a set-up CBCT, pre-treatment verification CBCT, and a post-treatment CBCT. At present, on a weekly basis, we acquire an additional 4D CBCT at the end of treatment. 4D CBCT data requires offline reconstruction. Using the advanced reconstructed module available on the Varian TrueBeam console, we used the 4D reconstruction mode, with 10 phases (phase bin width = 10%), using a medium ring suppression, and an ultrasharp filter. The reconstructed image has a 512 by 512 matrix size, and 2mm slice thickness. The reconstructed 4D CBCT was used to generate a cine loop of the tumor volume, which was then compared to the planning ITV. Image quality was also assessed.

Results: Using the TrueBeam platform, good quality 4D CBCT image can be acquired and reconstructed using the software tools provided by the vendor. In this analysis we observed that when the patient is breathing consistently, compared to the simulation CT, the 4D CBCT reveals that the planning ITV can be easily verified.

Conclusions: Findings of this study demonstrate that 4D CBCT is an effective alternative to otherwise invasive internal fiducials. Off-line review of this data allows the treating physician to monitor the tumor motion without the necessity of using invasive internal fiducials.

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