Purpose: Volumetric modulated arc therapy (VMAT) is a rotational intensity-modulated radiotherapy (IMRT) technique capable of acquiring projection images for cone-beam computed tomography (CBCT). Respiratory-correlated cone-beam computed tomography, namely 4D-CBCT, serves to assess the displacement of a tumor position between planning and treatment due to organ motion and respiration, and is important for more accurate radiation therapy. On the other hand, recently a 320-detector row CT scanner, namely 4D-CT, has become available that allows axial volumetric scanning of a 16-cm-long range in a patient without table movement. The goal of our research is to establish a new method of verification during treatment in stereotactic body radiotherapy. In this study, we compare the movement of the tumor between "before treatment" using 4D-CT and "in treatment" using 4D-CBCT.
Methods: Three patients (55-68 years of age) with lung tumors underwent CT scans for radiotherapy planning, 4D-CT scans to analyze the movement of the tumor before treatment. After planning and verification, the patients were treated by VMAT while acquiring projection images. The respiratory phase from the projection images was recognized by normalized cross correlation (NCC) and divided into four phases; peak-exhale, peak-inhale, and two intermediate phases. 4D-CBCT datasets were reconstructed from the projection images using in-house programs.
Results and Discussion: The tumor positions in 4D-CT and 4D-CBCT were detected and the movement of the tumor between "before treatment" and "in treatment" was similar. The movement of the tumors during treatment was predictable from 4D-CT before treatment. Furthermore, 4D-CBCT clarified the tumor position during treatment and could reevaluate the actual tumor position and dose distribution.
Conclusions: We have successfully shown that the movement of the tumor between "before treatment" using 4D-CT and "in treatment" using 4D-CBCT.