AbstractID: 9512 Title: On-Line Perfusion Measurement with Dynamic Contrast Enhanced Cone-Bean CT in Radiation Therapy

Purpose: On-line functional imaging might play an important role in the process of biological adaptive radiation therapy. This project is to develop a novel on-line system for perfusion measurement using dynamic contrast enhanced (DEC) cone-beam CT (CBCT) at the treatment unit.

Method and Materials: This novel technique involves a *single* baseline CBCT followed by a *single* contrast enhanced CBCT synchronized with contrast injection. It makes use of a mathematical expression to parameterize the wash-in and wash-out behavior of contrast uptake in each voxel. These parameters in each voxel were optimized using the projection data in the two CBCT scans. Three rabbits implanted with VX2 tumor at the upper limb were used for validating the method. The subjects were scanned with DCE-CBCT and DCE-CT at 2, 3 and 4 weeks after tumor implantation with the latter to be the gold standard. The time intensity curves of contrast uptake in tumors, normal tissues and blood vessels obtained from DCE-CBCT were compared with those from DCE-CT.

Results: The contrast enhancement in different tissue types estimated with the DCE-CBCT method had the general shape compared to the gold standard. The correlation between the initial slopes (a surrogate of perfusion) for different tissues obtained from DCE-CBCT and those from DCE-CT was found to be significant with $R=0.97$ ($p<0.001$). The *estimated* temporal contrast enhancement on the CBCT images appeared to be in excellent agreement with that on the DCE-CT images.

Conclusion: The proposed method has been shown to be able to estimate the temporal contrast enhancement using a baseline and a contrast enhanced CBCT in the rabbit model. By providing on-line perfusion measurement, this novel method is potentially useful in the process of adaptive radiation therapy.

Conflict of Interest (only if applicable):