

AbstractID: 13636 Title: Optical and x-ray image guided stereotactic body irradiator dedicated to small animals

Purpose: To develop a dual modality, optical and x-ray, image guided stereotactic irradiator, and to improve tumor visualization and the accuracy of target localization in small animal irradiation.

Method and Materials: A bioluminescence (BL) optical imaging system has been integrated into an existing x-ray image-guided stereotactic irradiator developed previously by our group. The new system provides precise target localization and accurate radiation delivery in three dimensions. All localization procedures are computer-controlled. An air-cooled CCD camera with sufficiently reduced dark current for better signal-to-noise ratio is employed for bioluminescence imaging. The CCD camera is positioned off-axis, in the same transverse plane as the x-ray radiation axis. To acquire BL images, the animal is rotated through a 30 degree angle towards the camera, and then back to the original (treatment) position for the x-ray imaging. The BL images are registered to the x-ray images for image guidance.

Results: The dual modality image guided irradiator was evaluated using an orthotopic lung tumor in a rat. The anterior and lateral BL images clearly showed the tumor with high contrast, while the same tumor was visible only in the anterior view in the x-ray images. This indicated that the x-ray image guidance alone is not sufficient to provide the precise localization. On the other hand, the registered BL and x-ray images overcome this limitation by combining information of tumor position in the BL image with the anatomy in the x-ray image.

Conclusion: The accuracy of tumor localization in small animal SBRT is dramatically improved by integrating optical imaging with x-ray imaging. The developed system also enhances the sparing of dose limiting normal tissues and organs-at-risk (OARs) and has facilitated accurate assessment of experiments in small animal SBRT investigations.

Conflict of Interest (only if applicable):