

Purpose: To establish the use of 3D ultrasound (US) combined with Active Breathing Control (ABC) for IGRT in liver lesions.

Methods: A 3D US device was used. An US probe was redesigned to obtain optimal probe tracking conditions for IGRT of the liver. At the treatment planning stage a reference US scan was performed in mid-ventilation, with the aid of an ABC system. US and mid-ventilation CT images were fused, the lesion was contoured and beams and isocenter from the treatment planning system were imported. Prior to each treatment an US scan in mid-ventilation was acquired. The current position of the lesion was compared to its reference position. The resulting 3D US shift was compared to the EPI shift.

Results: Due to breathing the liver deforms and the relationship between the lesion and surrogates, used as an assisting tool for US image segmentation, changes. The treatment plan is based on the 50% expiration CT images. Ideally, the IGRT method should guide the lesion to the same position as the planned position. In this study we demonstrated that the combination of US scanning and ABC optimized our image quality and resulted in a smaller inter- and intra-observation variation of image segmentation. We demonstrated a significant difference between US and EPI image guidance, demonstrating that IGRT based on bone structures alone is not sufficient.

Conclusions: Accurate IGRT in SBRT of liver lesions, using US imaging in combination with ABC is feasible. It allows accurate positioning of liver lesions in the treatment beams.