

**Purpose:** Contour propagation reduces effects of physician variability as well as the workload associated with manual contouring. However, its effect on PET based treatment response assessment is unknown. We compared the effects of manual contouring and deformable-registration-based contour propagation on treatment response assessment.

**Method and Materials:** Ten adult patients with various tumors underwent one pre-treatment and two follow-up whole body PET/CT scans [<sup>18</sup>F]FLT, a cellular proliferation marker. Most tumors were in proximity of highly deformable tissues, such as abdomen and lung. Manual contours of tumors were drawn on PET images by a nuclear medicine physician. Pre-treatment contours were chosen as the reference. Pre-treatment CT was deformably registered to follow-up CT using the fast-free-form deformable registration. Deformation fields resulting from the registration were used to propagate the reference to follow-up contours. A Matching index ( $\frac{C_{manual} \cap C_{propagated}}{C_{manual} \cup C_{propagated}}$ ) was used to quantify the overlapped volume of manual and propagated contours. Treatment responses using manual and propagated contours were then evaluated by calculating the relative change of  $SUV_{mean}$  ( $\Delta SUV_{mean}$ ) and  $SUV_{max}$  ( $\Delta SUV_{max}$ ) between pre-treatment and follow-up scans.

**Results:** The average matching index was 35% and ranged from 5% to 70%. This mismatch led to differences in treatment response assessment between manual contouring and contour propagation. The average difference in  $\Delta SUV_{mean}$  was 15% and ranged from 5% to 35%. While  $\Delta SUV_{max}$  had similar average difference and range, treatment responses using  $\Delta SUV_{max}$  of four patients were found to be insensitive to contouring methods. However, differences in  $\Delta SUV_{mean}$  always occurred.

**Conclusion:** The study showed that the treatment response was quite sensitive to different contouring methods. Fast-free-form deformable registration of tumor anatomy was insufficient to capture the change of tumor. Assistance of manual contour adjustment or other deformable registration is needed to fully capture the organ deformation on highly deformable tissues.