Purpose: PET-based treatment response assessment typically measures the change in SUVmax, which is adversely affected by noise. SUVpeak has been recommended as a more robust alternative, but currently its associated region-of-interest (ROIpeak) is not uniquely defined. We investigated the impact of different ROIpeak definitions on quantification of SUVpeak and tumor response.
Methods: Seventeen patients with solid malignancies were treated with an anti-proliferative, molecular targeted agent. Using the cellular proliferation marker [F-18]FLT, whole-body PET/CT scans were acquired at baseline and during treatment. Lesions with highest FLT uptake (~2/patient) were segmented on PET images and tumor response was assessed via the relative change in SUVpeak. For each tumor, 24 different SUVpeak and response values were determined by changing ROIpeak shape, size, and location. Within each tumor, variation of the 24 values was measured using range, coefficient of variation (CV) for SUVpeak, and standard deviation (SD) for response. For each ROIpeak definition, population average SUVpeak and response were determined over all tumors.
Results: Substantial variation in both SUVpeak and response resulted from changing the ROIpeak definition. Intra-tumor SUVpeak variation (CV: 17%) and response variation (SD: 9%) ranged as far as 50% from the mean. Population average SUVpeak variation (CV: 14%) ranged as far as 30% from the mean but population average tumor response variation (SD: 2%) ranged only 3% from the mean. Size of ROIpeak caused more variation in SUVpeak and response than location or shape of ROIpeak.
Conclusion: Quantification of individual tumor response using SUVpeak is highly sensitive to ROIpeak definition, which can significantly impact the use of SUVpeak for treatment response assessment. However, population average response is robust to ROIpeak definition. Standardization of SUVpeak is crucial for consistent assessment of treatment response. Clinical trials are necessary to compare the efficacy of SUVpeak and SUVmax for quantification of response to therapy.