Reproducibility of $[^{68}\text{Ga}]\text{DOTATOC}$ Imaging in Neuroendocrine Tumors

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**Background:** The potential utility of Gallium-68-labeled DOTA-D-Phe$^1$-Tyr$^3$-octreotide Positron Emission Tomography ($[^{68}\text{Ga}]\text{DOTATOC}$ PET) to effectively monitor response to therapy is dependent on the reproducibility of $[^{68}\text{Ga}]\text{DOTATOC}$ uptake.

**Objective:** To evaluate the reproducibility of uptake parameters of $[^{68}\text{Ga}]\text{DOTATOC}$ in patients with neuroendocrine tumors by PET.

**Methods:** Five subjects with metastatic neuroendocrine tumors were imaged with $[^{68}\text{Ga}]\text{DOTATOC}$ PET on two occasions. The interval between two scans was 1-5 days. Dynamic images of the chest or abdomen were obtained for 60 minutes followed by a whole-body PET/CT scan. Maximum pixel standardized uptake values ($\text{SUV}_{\text{max}}$) and the average SUV based on 50% thresholding of the maximum pixel SUV ($\text{SUV}_{\text{mean}}$) were calculated for up to 10 target lesions for each patient. Time-activity curves were determined for lesions identified on the dynamic frames with arterial plasma input functions generated from regions over major vessels (e.g., aorta). Patlak coefficients ($K$-Patlak) and $K$-influx derived from a two-tissue compartment model were calculated for each target volume of interest (VOI). The reproducibility (i.e., percent difference) was calculated for each parameter.
Results: $[^{68}\text{Ga}]\text{DOTATOC}$ uptake in lesions was highly reproducible. The correlation coefficient for $\text{SUV}_{\text{max}}$ and $\text{SUV}_{\text{mean}}$ between the first and second scan was 0.99. The mean difference for $\text{SUV}_{\text{max}}$ and $\text{SUV}_{\text{mean}}$ between two scans ($n=47$) were $9.8\pm 7.9\%$ and $12.1\pm12.3\%$, respectively. Kinetic parameters ($n=21$) had poorer reproducibility due to variability in the input function determination. The mean difference was $20.9\pm16.2\%$ for $K\text{-Patlak}$ and $31.1\pm33.5\%$ for $K\text{-influx}$.

Conclusions: These data suggest that an 18-24% difference (mean +1 SD) in $\text{SUV}_{\text{max}}$ or $\text{SUV}_{\text{mean}}$ is needed to confirm a biological change in tumor uptake of $[^{68}\text{Ga}]\text{DOTATOC}$ between two studies.