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Reproducibility of [^{68}Ga]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}Ga]DOTATOC PET) to effectively monitor response to therapy is dependent on the reproducibility of [^{68}Ga]DOTATOC uptake.

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

Methods: Five subjects with metastatic neuroendocrine tumors were imaged with [^{68}Ga]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 (SUV_{max}) and the average SUV based on 50% thresholding of the maximum pixel SUV (SUV_{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}Ga]DOTATOC uptake in lesions was highly reproducible. The correlation coefficient for SUV_{max} and SUV_{mean} between the first and second scan was 0.99. The mean difference for SUV_{max} and SUV_{mean} between two scans (n=47) were 9.8± 7.9% and 12.1±12.3%, respectively. Kinetic parameters (n=21) had poorer reproducibility due to variability in the input function determination. The mean difference was 20.9±16.2% for K-Patlak and 31.1±33.5% for K-influx.

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