Whole-body Biodistribution of 3'-deoxy-3'-[18F]fluorothymidine (^{18}FLT) in Normal Adult Cats

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Introduction

Positron emission tomography (PET) is a functional imaging technology which utilizes positron-emitting radionuclides coupled to biologically important molecules in order to map complex physiologic processes. The resultant images represent the distribution and accumulation of the radiopharmaceutical tracer in specific areas of the body closely related to the underlying biologic process of interest. Fusion of functional PET data with the high-resolution anatomic data obtained via computed tomography (CT) results in a powerful diagnostic tool.

3'-deoxy-3'-[18F]fluorothymidine (^{18}FLT), a marker of cellular proliferation, has garnered attention as a useful tool for characterization of both neoplastic disease and bone marrow function. While certainly not as widespread as in human facilities, PET/CT is increasingly available in veterinary medicine. As a result, normal biodistribution of ^{18}FLT in veterinary species is needed for lesion interpretation in the clinical setting.

Objective

The purpose of this preliminary study is to describe the normal whole-body biodistribution pattern of ^{18}FLT in adult domestic cats.

Methods

Imaging of six healthy adult male cats obtained from a closed research colony was performed using a commercially available PET/CT scanner which combines a 64-slice helical CT scanner with a whole-body, high-resolution LSO PET scanner. Cats were sedated and injected intravenously with 108.60 ± 2.09 (mean ± SD) MBq of ^{18}FLT (radiochemical purity verified by HPLC). General anesthesia was induced and cats placed in ventral recumbency on the scanner bed. Static images were acquired beginning 60 min post-injection.

Utilizing dedicated analysis software, regions of interest (ROIs) were manually drawn over sites of clinical relevance and increased tracer uptake, including major parenchymal organs and selected areas of bone marrow. Standardized Uptake Values (SUVs) were calculated using an established formula. All results are decay corrected to injection time.

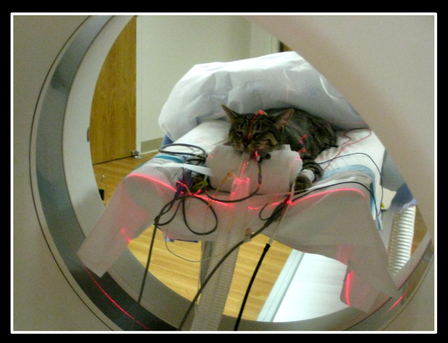

Figure 1: Anesthetized adult cat positioned within the PET/CT scanner immediately prior to scanning.

Region of Interest	SUV_{mean} (mean ± SD)	SUV_{max} (mean ± SD)
Urinary Bladder	157.55 ± 55.73	220.38 ± 69.14
Gallbladder	9.62 ± 2.46	11.29 ± 3.12
Renal Cortex	Left: 4.40 ± 0.81 Right: 4.26 ± 0.86	Left: 6.16 ± 1.52 Right: 6.12 ± 1.48
Liver	3.75 ± 0.38	4.00 ± 0.44
Proximal Humerus	Left: 3.63 ± 1.02 Right: 3.78 ± 0.97	Left: 4.93 ± 1.55 Right: 4.76 ± 1.35
Distal Femur	Left: 2.89 ± 0.78 Right: 2.70 ± 0.80	Left: 3.84 ± 1.13 Right: 3.75 ± 1.20
Caudal Ilium	Left: 2.82 ± 0.94 Right: 2.64 ± 0.81	Left: 3.19 ± 1.10 Right: 2.87 ± 0.87
Sternum	2.27 ± 0.69	2.44 ± 0.78
Proximal Femur	Left: 1.79 ± 0.64 Right: 1.77 ± 0.71	Left: 2.01 ± 0.78 Right: 2.01 ± 0.82
Iliac Wing	Left: 1.70 ± 0.37 Right: 1.74 ± 0.28	Left: 1.84 ± 0.59 Right: 1.87 ± 0.40
Spleen	0.93 ± 0.13	1.18 ± 0.15
Epaxial Muscle	0.91 ± 0.10	0.96 ± 0.11
Myocardium	0.79 ± 0.10	0.84 ± 0.12
Lung	0.25 ± 0.04	0.28 ± 0.05
Brain	0.25 ± 0.06	0.47 ± 0.10

Table 1: Mean and maximum SUV calculations based on manually drawn ROIs utilizing 60 min post-injection static FLT-PET/CT images in normal adult cats. Results are decay corrected to injection time.

Figure 2: Ventral (A) and lateral (B) static whole-body PET/CT images illustrating biodistribution of ^{18}FLT in a normal adult cat 60 min post-injection.

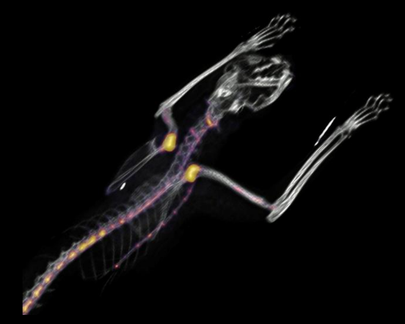

Figure 3: Oblique static ^{18}FLT-PET/CT image illustrating tracer concentration in proximal humeri (a common site for marrow collection).

Figure 4: Oblique static ^{18}FLT-PET/CT image illustrating tracer uptake within the pelvis, vertebral column, and femora. Note the intense uptake within the distal femora.

Results and Discussion

^{18}FLT-PET/CT appears to have similar biodistribution and imaging characteristics in domestic cats as in other species. Notable areas of increased bone marrow uptake include proximal humeri, caudal ilia, distal femora, sternum, and vertebral bodies. Kidneys, liver, gallbladder, intestinal tract, and urinary bladder display relatively intense uptake consistent with radiopharmaceutical metabolism and excretion. No appreciable brain or lung uptake is observed.

^{18}FLT-PET/CT holds promise as a viable imaging modality for the characterization of neoplastic disease and bone marrow proliferative activity in the domestic cat .This study demonstrates the normal uptake pattern of ^{18}FLT in healthy adult cats and will provide baseline data for future studies in this species.

Acknowledgements

Funding provided in part through a grant provided by the University of Tennessee Department of Small Animal Clinical Sciences Companion Animal Fund.

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