4-13 Development of a Novel Radiopharmacutical Finding Even Very Small Tumors
—Success in PET Imaging of Pheochromocytomas Using ^{76}Br-MBBG—

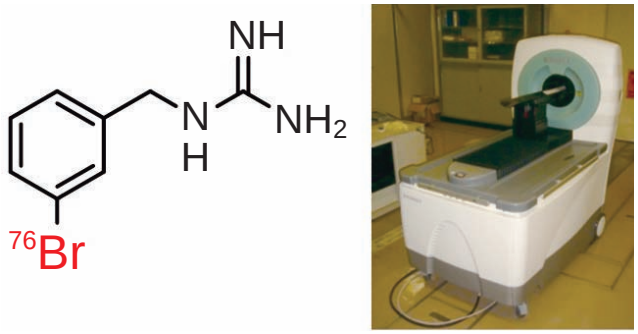

Fig.4-25 Chemical structure of ^{76}Br-MBBG (left) and photo of a small-animal PET (right)
^{76}Br-MBBG (^{76}Br-*meta*-bromobenzylguanidine) is a positron emitter ^{76}Br (half-life: 16.1 h) labeled compound which shows specific uptake into pheochromocytoma. ^{76}Br-MBBG was administrated to pheochromocytoma bearing mice, and PET scans were performed using a small-animal PET for 20 min emission scanning.

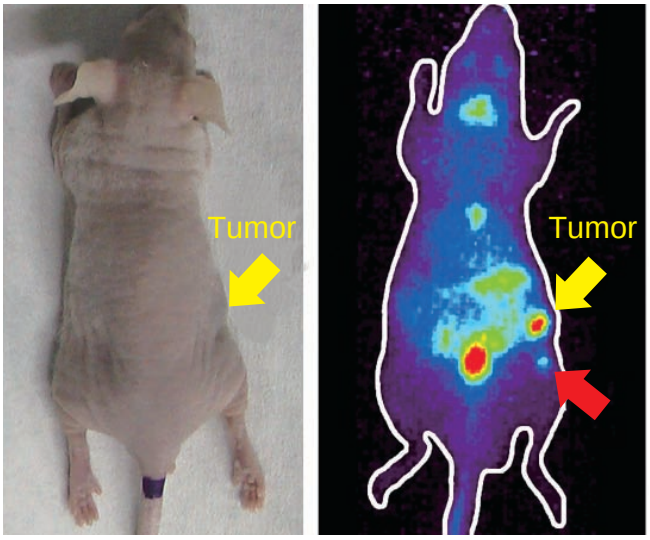

Fig.4-26 Photo of a pheochromocytoma-bearing mouse (left) and PET imaging at 3 h after administration of ^{76}Br-MBBG (right)
Yellow arrows indicate the position of implanted pheochromocytoma. ^{76}Br-MBBG showed higher accumulation in tumor compared to normal tissues (green or purple regions). High accumulation in the center of the mouse showed urine in the bladder. The red arrow shows a very small tumor (size: 2 mm) undetected before PET.

Pheochromocytoma is a tumor in the medulla of the adrenal glands. This tumor secretes excessive amounts of catecholamines such as epinephrine (adrenaline), which causes heavy hypertension. Although pheochromocytoma is usually curable by surgical resection, patients with small lesions or multiple metastases will be fatal because other treatments are not effective. Thus, early detection is critical to cure the pheochromocytoma. However, it is difficult to detect a small lesion or early metastasis using X-ray computed tomography (CT) or single photon emission computed tomography (SPECT) due to their lower spatial resolution.

We focused on positron emission tomography (PET) to overcome the above-mentioned problems. PET is a nuclear imaging technology that images distribution of lesions or metabolic activity in tissues of interest by detecting γ-rays from positron emitters. PET has a high potential to detect small tumors, since it has a higher spatial resolution compared to CT and SPECT. A positron emitter labeled compound that shows specific uptake into pheochromocytoma thus can be a promising tracer for detecting small pheochromocytoma using PET. We synthesized the positron emitter Br-76 (^{76}Br) labeled ^{76}Br-*meta*-bromobenzylguanidine (^{76}Br-MBBG), which has high affinity to pheochromocytoma.

^{76}Br-MBBG was administrated to tumor bearing mice and PET scans were performed at 3 h after administration (Fig.4-25). As a result, transplanted tumors were successfully imaged using ^{76}Br-MBBG. Furthermore, a small tumor (size: 2 mm) undetected before PET scans was clearly imaged (Fig.4-26). These results indicated that ^{76}Br-MBBG is a potential radiopharmaceutical for imaging pheochromocytoma and detecting very small tumors.

^{76}Br-MBBG could be a powerful tool for early detection of pheochromocytoma. Furthermore, ^{76}Br-MBBG could also be provided for imaging neruoblastoma, medullary thyroid carcinoma, and carcinoid which specifically accumulate ^{76}Br-MBBG like pheochromocytoma.

Reference

Watanabe, S. et al., PET Imaging of Norepinephrine Transporter-Expressing Tumors Using ^{76}Br-*meta*-Bromobenzylguanidine, The Journal of Nuclear Medicine, vol.51, no.9, 2010, p.1472-1479.