Nonfunctioning Periurethral Paraganglioma Incidentally Detected by FDG PET/CT

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Abstract Paragangliomas are extra-adrenal neuroendocrine tumors that are derived from neural crest cells. Among all the paragangliomas, those in a pelvic location are extremely rare. In addition, the prevalence of nonfunctioning paragangliomas is underestimated because of their clinical latency, and they are often underdiagnosed unless they cause symptoms. We report a case of a nonfunctioning

periurethral paraganglioma that was incidentally detected by FDG PET/CT during regular follow-up after excision of a melanoma on the left thumb.

Keywords Nonfunctioning periurethral paraganglioma · Extra-adrenal pheochromocytoma · FDG PET/CT

Introduction

Paragangliomas are also called extra-adrenal pheochromocytomas. These are rare tumors that originate from neural crest cells, and they affect 1 in 2,000,000 people [1]. Paragangliomas in a pelvic location are extremely rare and account for 2% of all the paragangliomas [2]. Pheochromocytomas are clinically significant because they can be a surgically treatable cause of hypertension in patients with excessive catecholamine production. In contrast, nonfunctioning paragangliomas are underestimated because of their clinical latency, and they are often underdiagnosed unless they cause nonspecific symptoms such as low back pain. However, paragangliomas have been reported to be malignant in up to 50% of the cases [3], so medical concern about their appropriate management is needed even for non-functioning paragangliomas.

Positron emission tomography/computerized tomography (PET/CT) with [^{18}F] fluorodeoxyglucose (FDG) has been widely used in oncology for the purpose of an initial workup and also surveillance for tumor recurrence. Interestingly, quite a number of tumors, ranging from thyroid tumors to rare tumors, are incidentally found by FDG PET/CT. We report a case of a patient with nonfunctioning periurethral paraganglioma that was incidentally detected by FDG PET/CT during regular follow-up after excision of a melanoma on the left thumb.

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Fig. 1 The axial CT image (a), and the axial (b) and coronal (c) fusion PET/CT images show a hypermetabolic mass (arrow) inferior to the urinary bladder on the recent PET/CT examination. The axial

CT image (d), and the axial (e) and coronal (f) fusion PET/CT images that were taken 20 months previously show the hypermetabolic mass (arrow) in the same area

Case Report

A 63-year-old female who had undergone surgical removal of a melanoma on the left thumb 2 years previously underwent FDG PET/CT for regular follow-up at a 6-month interval. The whole-body FDG PET/CT images were acquired using a Siemens Biograph 40 Truepoint (Siemens Medical Solutions, Hoffman Estates, IL) after intravenous injection of 255 MBq (6.9 mCi) FDG. PET/CT revealed a hypermetabolic mass

with low attenuation around the area of the urinary bladder neck. This low attenuation mass was approximately 2 cm in diameter and showed higher FDG uptake with a maximal standardized uptake value (SUV_{max}) of 12.4 than the adjacent urine FDG activity (SUV_{max} of 4.3) (Fig. 1a, b and c). Except for the incidentally found pelvic mass, no other abnormal hypermetabolic lesion suspicious for local tumor recurrence or distant metastasis was seen on the whole-body PET/CT images. On the retrospectively reviewed preopera-

Fig. 2 T1-weighted axial (a), T2-weighted axial (b) and T2-weighted coronal MR image (c) show a 1.8×1.3-cm well-circumscribed mass (arrow) inferior to the urinary bladder and anterior to the urethra

Fig. 3 Immunohistochemical analysis shows positivity for chromogranin (a) and synaptophysin (b)

tive PET/CT images that had been obtained 20 months previously, the 2-cm hypermetabolic mass (SUV_{max} of 16.8) was also seen in the same area, but it was hardly discernable because of the adjacent urine FDG activity (SUV_{max} of 16.1) (Fig. 1d, e and f).

For further characterization of the pelvic mass, diagnostic studies including magnetic resonance imaging (MRI) and cystoscopy were performed. The MR images demonstrated a 1.8×1.3-cm well-circumscribed mass inferior to the urinary bladder and anterior to the urethra, which showed intermediate-to-high signal intensity on the T2-weighted image and intermediate-to-high signal intensity on the T1-weighted image with persistent contrast enhancement (Fig. 2). Cystoscopy revealed no abnormal findings in the urinary bladder and urethra. In addition, no abnormal finding was found in the vagina via a physical examination.

The perivesical mass was laparoscopically removed, and the gross examination of the resected specimen showed clear resection of the margins. The cross-sectional investigation of the specimen revealed a well-demarcated, light gray-colored mass with no hemorrhage or necrosis inside. The pathological report confirmed it was an extra-adrenal paraganglioma of the pelvis. On immunohistochemical analysis of the neural crest cell origin markers, the specimen showed strong positivity for chromogranin and synaptophysin, and focal positivity in the sustentacular cells for S-100 (Fig. 3).

Discussion

Paragangliomas, which are also called pheochromocytomas, are rare tumors derived from neural crest cells and are classified as neuroendocrine tumors. Most neuroendocrine tumors are known to have a two-phase metabolic profile; low or absent FDG uptake in the early stage followed by increased FDG uptake in the later stages [4]. Owing to this unique characteristic of neuroendocrine tumors, FDG PET/CT has not been widely used for assessing neuroendocrine tumors. However, unlike other neuroendocrine tumors, paragangliomas show high FDG uptake even in cases of

benign tumors [5]. In addition, FDG PET has been reported to have an excellent ability to localize malignant paragangliomas, and this is related to the mitochondrial complex II enzyme succinate dehydrogenase subunit B (SDHB) mutation [6]. This complex metabolic pattern of paragangliomas seems to be a reason for the low specificity of FDG PET/CT in differentiating them.

The patient in this case presented with a nonfunctioning periurethral paraganglioma that had a markedly increased FDG uptake, and it was incidentally detected by FDG PET/CT during a regular follow-up visit for melanoma. This paraganglioma was proved benign by the histopathology, and it was presumed to be a non-hormone-secreting tumor based on the patient's clinical status. According to previous studies, benign pheochromocytomas could exhibit increased FDG uptake without any correlation with the catecholamine levels [7, 8]. Despite the enhanced FDG uptake of the tumor, the diagnosis was delayed over 20 months because of the location of the tumor, which was in proximity to the urinary bladder. The evaluations of the urinary system and adjacent structures are often hampered by strong urine FDG activity, so thorough inspection and careful interpretation by nuclear medicine physicians are required.

This case exhibited atypical MR findings for paragangliomas, which made the differential diagnosis confusing. Pelvic paragangliomas usually show hypointensity on T1-weighted images, hyperintensity on T2-weighted images and intense contrast enhancement [9]. In the case presented here, the tumor showed intermediate-to-high signal intensity on the T2-weighted image and intermediate-to-high signal intensity on the T1-weighted image with persistent contrast enhancement on the MRI. Based on these findings, metastatic melanoma and primary retroperitoneal tumor such as leiomyoma/leiomyosarcoma were suggested as the differential diagnoses. Pheochromocytomas or paragangliomas have various appearances on MRI, and they can mimic many other tumors [10].

In summary, we report here on a case of a nonfunctioning periurethral paraganglioma that was incidentally detected by FDG PET/CT during regular follow-up after

excision of a melanoma on the left thumb. The detection of a paraganglioma adjacent to the urinary system is difficult because of strong urine FDG activity, and so nuclear medicine physicians should very carefully interpret hyper-metabolic lesions that are adjacent to the urinary system to detect a paraganglioma.

References

1. Mathouse SR, Robinson L, Rankin SC. Ultrasonic and computed tomographic appearances of paraganglioma simulating pancreatic mass. *Clin Radiol*. 1992;45:271–2.
2. Frezza EE, Ikramuddin S, Gourash W, Schauer P. Laparoscopic resection of a large periadrenal nonmalignant pheochromocytoma. *Surg Endosc*. 2002;16:362–3.
3. Zarnegar R, Kebebew E, Duh QY, Clark OH. Malignant pheochromocytoma. *Surg Oncol Clin N Am*. 2006;15:555–71.
4. Adams S, Baum R, Rink T, Schumm-Dräger P, Usadel K, Hör G. Limited value of fluorine-18 fluorodeoxyglucose positron emission tomography for the imaging of neuroendocrine tumours. *Eur J Nucl Med*. 1998;25:79–83.
5. Tessonnier L, Sebag F, Palazzo FF, Colavolpe C, De Micco C, Mancini J et al. Does ^{18}F -FDG PET/CT add diagnostic accuracy in incidentally identified non-secreting adrenal tumours? *Eur J Nucl Med*. 2008;35:2018–25.
6. Timmers HJLM, Kozupa A, Chen CC, Carrasquillo JA, Ling A, Eisenhofer G et al. Superiority of fluorodeoxyglucose positron emission tomography to other functional imaging techniques in the evaluation of metastatic SDHB-associated pheochromocytoma and paraganglioma. *J Clin Oncol*. 2007;25:2262–9.
7. Taïeb D, Tessonnier L, Sebag F, Niccoli-Sire P, Morange I, Colavolpe C et al. The role of ^{18}F -FDOPA and ^{18}F -FDG-PET in the management of malignant and multifocal phaeochromocytomas. *Clin Endocrinol*. 2008;69:580–6.
8. Pauwels EK, Sturm E, Bombardieri E, Cleton EJ, Stokkel MPM. Positron emission tomography with [^{18}F]fluorodeoxyglucose. Part I. Biochemical uptake mechanism and its implication for clinical studies. *J Cancer Res Clin Oncol*. 2000;126:549–59.
9. Sahdev A, Sohaib A, Monson JP, Grossman AB, Chew SL, Reznick RH. CT and MR imaging of unusual locations of extra-adrenal paragangliomas (pheochromocytomas). *Eur Radiol*. 2005;15:85–92.
10. Blake MA, Kalra MK, Maher MM, Sahani DV, Sweeney AT, Mueller PR et al. Pheochromocytoma: an imaging chameleon. *Radiographics*. 2004;24(Suppl 1):S87–99.