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Case report

FDG-PET and CT findings of activated brown adipose tissue in a patient with paraganglioma

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ABSTRACT

A 17-year-old female had been complaining of a headache for 6 years. She presented severe hypertension (200/138 mmHg) on admission. CT showed a hypervascular tumor behind the urinary bladder and a swelling of the right internal obturator node. Intense FDG uptakes were identified in the both lesions. High FDG accumulation was also observed in the brown adipose tissue (BAT) throughout the patient's body, and intense contrast enhancement was found in the BAT on CT. The diagnosis was a malignant paraganglioma with obturator node metastasis. The post-surgery FDG-PET/ CT examination revealed that the FDG accumulations in the BAT had completely disappeared.

1. Introduction

F-18 fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) has been used in many clinical settings to deal with malignant tumors, and it has become an indispensable imaging tool for managing patients with malignant tumors. Although FDG intrinsically accumulates in many types of malignant tissues, physiological FDG uptakes — including those in brown adipose tissue (BAT) — have also been widely recognized, and the physiological FDG uptakes might lead to false-positive results.

BAT is present primarily in infants and young children, but healthy adults also possess significant deposits of BAT [1,2]. BAT plays an important role in the maintenance of body temperature [3], and it can be activated by ß-adrenergic activators such as catecholamines [4–7]. Several studies have demonstrated that pheochromocytoma/paraganglioma-secreted catecholamines and BAT can be activated by elevated plasma catecholamines [4,5].

We present the case of a young woman diagnosed with a malignant paraganglioma behind the urinary bladder. FDG-PET/CT showed increased FDG uptake in BAT throughout her body. She also underwent contrast-enhanced CT, which revealed an intense enhancement of contrast medium not only in the primary tumor but also in BAT located at the retroperitoneum and mesentery. We provide characteristic FDG-PET and contrast-enhanced CT image findings of the BAT activated by the patient's pelvic paraganglioma, and we discuss the potential mechanisms underlying these findings in reference to several relevant reports.

2. Case report

A 17-year-old woman was referred to our hospital after reporting a headache that had persisted for 6 years. She had also suffered from hyperhidrosis, palpitation, and paroxysmal hypertension just after micturition for the prior 3 years. Her systolic blood pressure had occasionally been > 160 mmHg. These symptoms had worsened over the month prior to her referral to us, and she was admitted to our hospital because of a hypertension attack. On admission, she was 153 cm tall and weighed 44.9 kg, with a BMI of 19.2. She had hypertension (200/138 mmHg) and tachycardia (120 beats per min). She has no family or personal history of any malignant or benign neoplasm.

Her serum noradrenaline was 6218 pg/mL (normal ≤100 pg/mL); her adrenaline level was 54 pg/mL (normal ≤450 pg/mL), and the dopamine level was 42 pg/mL (normal ≤20 pg/mL). Her urinary fractionated normetanephrine level was 6.45 μg/mg•Cre. A 24-hr urine collection test revealed a urinary fractionated normetanephrine level of 4.99 mg/day (normal 0.09–0.33 mg/day) and a noradrenaline level of 2188.8 μg/day (normal 48.6–168.4 μg/day). Her HbA1c (NGSP) was 5.7%. The fasting blood glucose level was 143 mg/dL. No gross or microscopic hematuria was detected.

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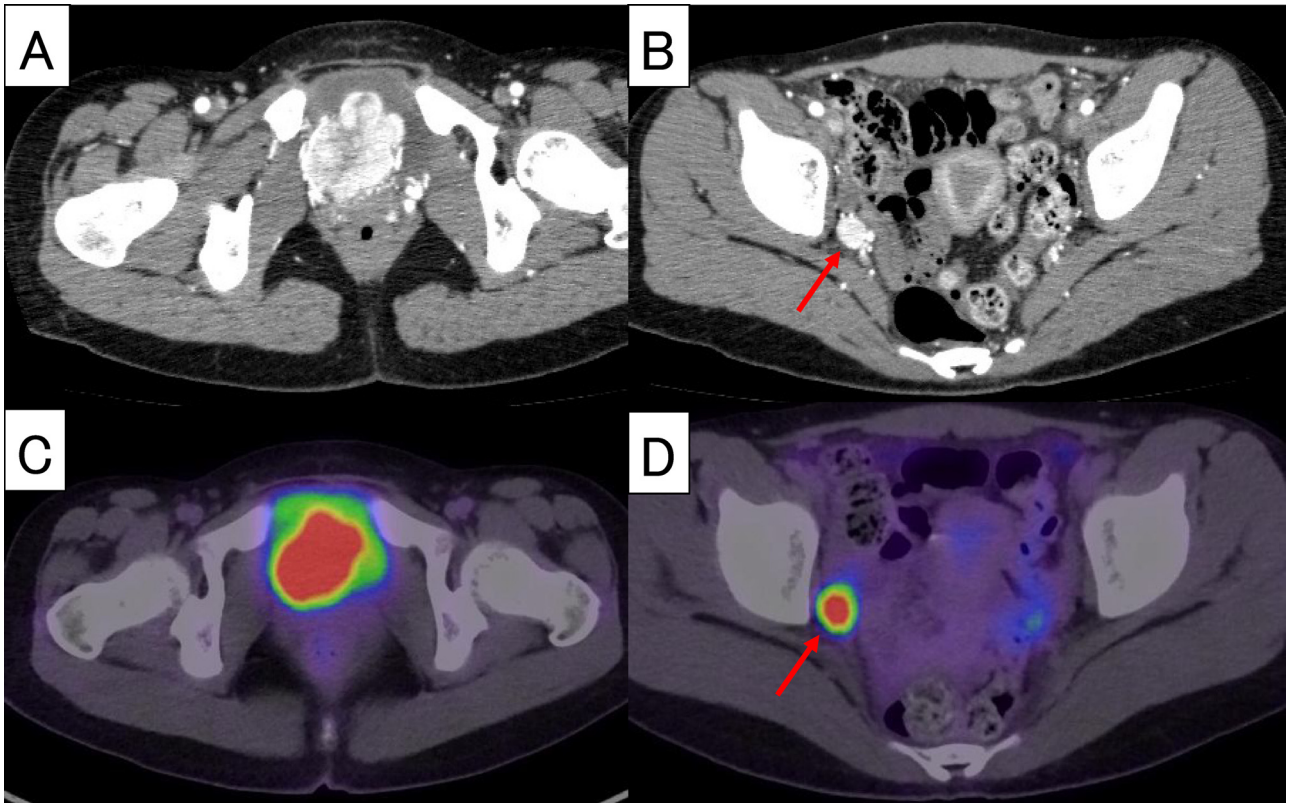

Fig. 1. CT and FDG-PET/CT images of the pelvic paraganglioma and lymph node metastasis of the patient, a 17-year-old female. Axial CT images showed a hypervascular well-defined and lobulated mass (55 mm in long dia.) located dorsocaudal to the urinary bladder (**A**) and enhanced lymph node swelling (15 mm in short dia.) at the right internal obturator region (**B**, *red arrow*). **C,D:** Intensely high FDG accumulation in the tumor and the lymph node with SUVmax values of 24.7 and 20.8, respectively.

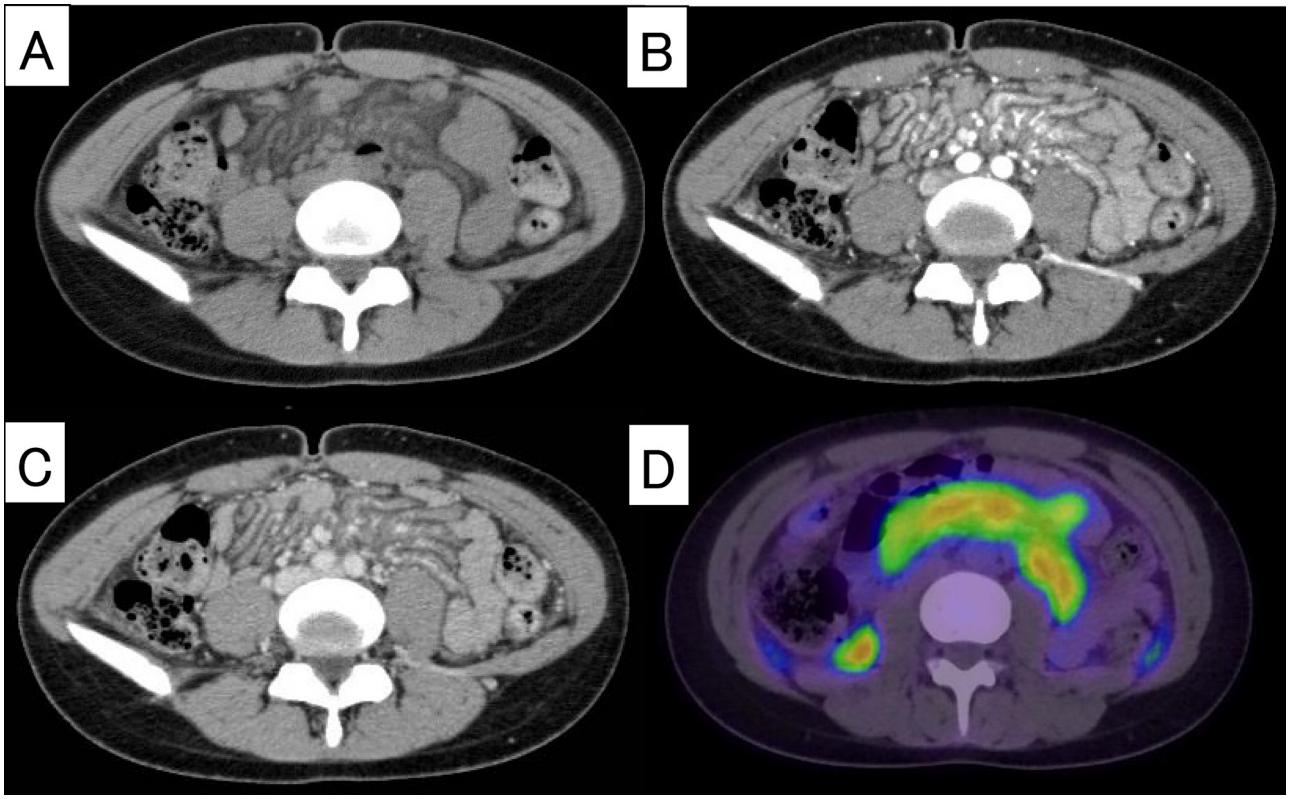

Fig. 2. CT and FDG-PET/CT images of activated mesenteric BAT. **A:** Axial non-contrast-enhanced CT showed increased attenuation of the visceral fat tissues. Contrast-enhanced CT showed early enhanced (**B**) and delayed washed out (**C**) and a spaghetti-like appearance in the mesentery. Intense FDG accumulation in the mesentery was observed (**D**, SUVmax = 8.1).