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Cold tuberculous abscess identified by FDG PET

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We report FDG PET of two cases of cold abscess due to *Mycobacterium tuberculosis*. Case 1 had colon cancer; FDG PET showed high FDG uptake in the colon lesion and low uptake in the inguinal lesion. The latter was a tuberculous cold abscess confirmed by CT/MRI and biopsy. Case 2 received radiotherapy for lung cancer and presented with suspected vertebral metastasis. Further studies revealed tuberculosis of the vertebra and a tuberculous cold abscess in the iliopsoas muscle. FDG PET showed moderate uptake in the third lumbar spine and low uptake in the abscess center of iliopsoas lesion. Both tuberculous cold abscesses showed moderate FDG uptake in the capsule and low uptake in the center. These features are unique compared with non-tuberculous abscess and typical tuberculosis lesions, which are characterized by high FDG uptake. Pathologically, tuberculous cold abscess is not accompanied by active inflammatory reaction. Our findings suggested that the FDG uptake by tuberculous lesion varies according to the grade of inflammatory activity. The new diagnostic features of tuberculous cold abscess may be useful in the evaluation of such lesions by FDG PET.

Key words: FDG, PET, tuberculosis, abscess, inflammation

INTRODUCTION

POSITRON EMISSION TOMOGRAPHY (PET) imaging with fluorine-18 fluorodeoxyglucose (FDG) has played an important role in the diagnosis of various tumors. After injection of FDG, it is taken up and trapped within tumor cells at a higher rate than in normal cells, a feature reflecting elevated glucose metabolism in cancer cells. This functional information obtained by FDG PET has facilitated the diagnosis and staging of cancer non-invasively with a high level of accuracy.[1] However, FDG is not specific for tumors, and active inflammation such as tuberculosis also shows high FDG uptake.[2,3] This is problematic for the differential diagnosis of malignancy. This property can be applied for the detection of the site of inflammation in patients with fever of unknown origin.[4]

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Tuberculosis is a typical FDG avid inflammation.[5] However, there are several different pathological types of tuberculosis lesions. Cold abscess has unique pathological findings of large necrotic lesion and thin capsule but, to our knowledge, its FDG PET features have not yet been described. We report two patients with cold abscess diagnosed in 2003 and 2004 in whom FDG PET was performed to survey possible cancer lesions. Here we report the FDG PET findings of cold abscess.

CASE REPORTS

Case 1

A 65-year-old woman had had multiple abscesses in psoas muscle, right inguinal, paravertebral and ostolytic lesion in ischium from two months earlier. *Mycobacterium tuberculosis* was detected in the abscess, and anti-tuberculosis therapy had been started 3 weeks earlier. She was referred to our center for surgical therapy. She also complained of melena. Her CEA and CA19-9 levels were elevated, and CT scan suggested a rectal mass. But colonoscopy was refused. For further diagnosis of the colon lesion, FDG PET was performed. One hour after intravenous injection of 370 MBq of FDG, whole body

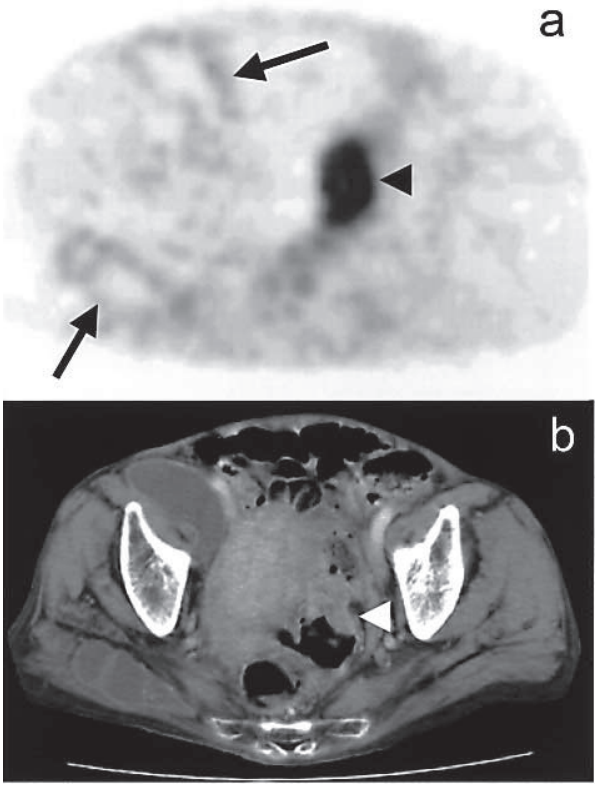

Fig. 1 Case 1, FDG PET(a) showed moderate uptake in the capsule and low uptake in the center of the tuberculous abscess (*arrows*), and intense accumulation corresponding to rectal cancer (*arrowhead*). Benign myoma uteri in CT showed no FDG uptake in PET. Contrast-enhanced CT (b) showed right inguinal and gluteus abscess with thin capsule and mass lesion of the rectum (*arrowhead*).

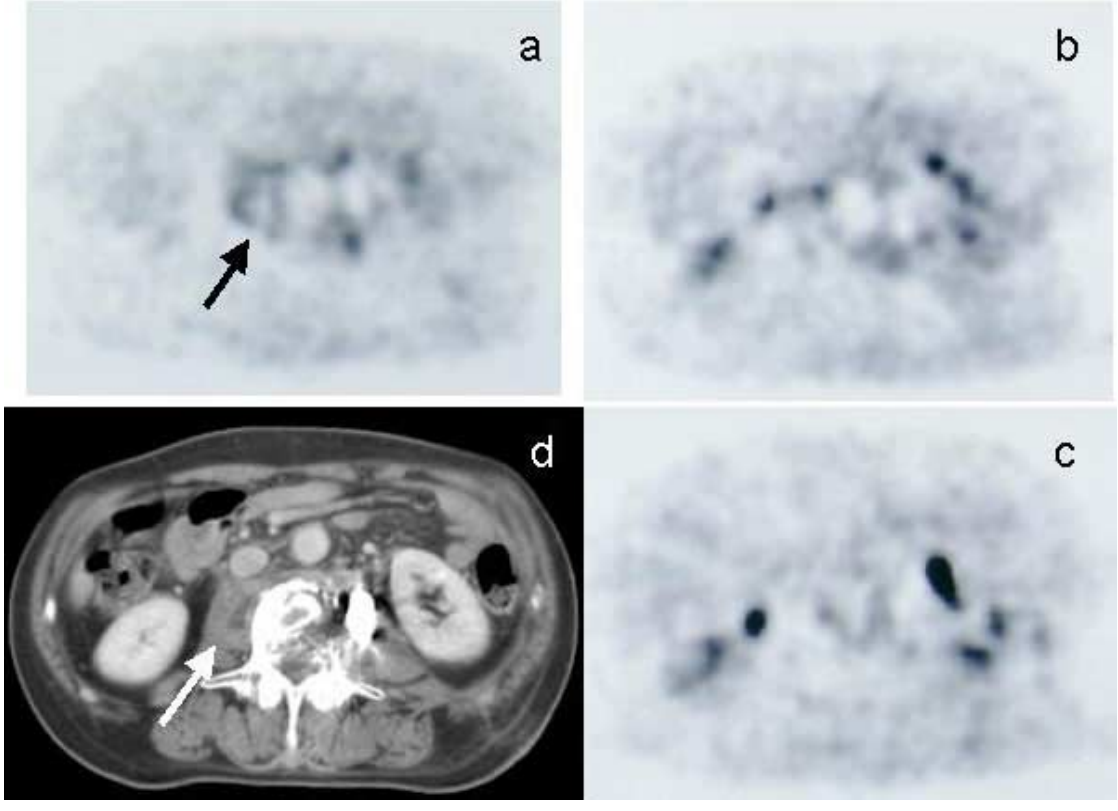

Fig. 2 Case 2, FDG PET showed moderate accumulation corresponding to the capsule of the abscess (*arrow*), low uptake in the abscess center, and moderate uptake lesions in the left vertebrae, consistent with tuberculosis lesion of the vertebrae (a–c). Contrast enhanced CT showed abscess formation in the right iliopsoas muscle (*arrow*), and destruction of the vertebral bone (d).

PET imaging was performed using a dedicated PET system (Shimadzu, Headtome 4, Kyoto, Japan). The PET study demonstrated high FDG uptake (SUV: 8.38) corresponding to the rectal mass on CT. Rectal carcinoma was suspected, and no lymph node metastasis was detected. PET images of the right inguinal and right gluteal regions showed moderate accumulation of FDG in the capsule and a low uptake area in the abscess center (SUV of inguinal lesion, capsule, center, back muscle as control: 1.26, 0.175, 0.711 respectively). The abscess was also confirmed on the CT and MRI studies (Fig. 1a, b). High anterior resection of the rectum was performed and adenocarcinoma of the rectum was demonstrated.

Case 2

A 63-year-old man who had received radiotherapy for lung cancer complained of low back pain. Lumbar bone metastasis was suggested by CT, and palliative irradiation was performed. But the low back pain worsened, and progression of the bone lesion was observed. *M. tuberculosis* was demonstrated by sputum culture, and anti-tuberculosis therapy was started. Radiotherapy was found to have been inappropriate. MRI showed compression fracture of the 3rd lumbar spine as well as a new finding of fluid collection in the iliopsoas muscle. At the surgery for the fixation of 3rd lumbar spine with a metallic plate, *M. tuberculosis* was detected from a paravertebral abscess. FDG PET was performed a month later and demonstrated moderate accumulation corresponding to the capsule of the abscess with low uptake in the center of the abscess in the iliopsoas muscle (SUV of capsule and center: 2.17, 0.81 respectively, back muscle: 0.684), and a moderate accumulation in the 3rd lumbar spine lesion (SUV: 3.72), probably representing tuberculosis vertebral caries (Fig. 2a, b). Anti-tuberculosis therapy was continued.

DISCUSSION

Our results can be summarized as follows: in our two cases, FDG PET showed moderate accumulation in the capsule, and low uptake in the center of the cold abscess formed by *M. tuberculosis*. Histopathologically, the large tuberculosis lesion was invaded by polymorphonuclear cells and underwent liquefaction. The liquefied lesion often drains into the inter-muscle space and forms an abscess with a thin capsule. Such lesions are known as 'cold abscess,' because they are not accompanied by active inflammation. It is known that FDG accumulates in abscesses which are typically seen in pyogenic bacterial infection. This is explained by uptake of FDG by activated immunocytes such as macrophages, granulocytes, and by young granulation tissue surrounding the abscess.[6,7] Hence, in the absence of active inflammatory tissue, glucose metabolism in cold abscess is low, and FDG PET demonstrates a low uptake in the center, surrounded by a capsule of moderate FDG uptake. In both patients, anti-tuberculosis therapy had already started a few weeks before PET, but its effect on the activity of inflammation seems to have been not large, because the duration of the therapy was shorter than the standard 6-month course of anti-tuberculosis therapy, and the therapeutic response of the chronic inflammation may be slower than that of the acute inflammation.

Ichiya et al.[3] identified 7 of 8 lung lesions and an osteomyelitis caused by tuberculosis by FDG PET. In their study, high FDG uptake was noted in 23 of 25 lesions regardless of either the causative microorganisms or the degree of lesion activity. The acute active lesions showed higher FDG uptake than the chronic active or healing lesions. Bakheet et al.[5] reported two cases of FDG avid lymphadenitis and tuberculosis pulmonary lesions. Sanabe et al.[8] reported a case of pancreatic tuberculosis with high FDG uptake. These reports suggest that most tuberculosis lesions located in the lung and other areas show high FDG uptake. Previous studies indicated that non-tuberculosis acute or chronic infection or inflammation showed high FDG uptake.[9–14] In addition, Park et al.[15] reported bilateral iliopsoas tuberculous abscesses, which appeared as hypermetabolic lesions on FDG images. In contrast to the above reports, our observation of two cases of "cold abscess" of tuberculosis showed moderate uptake in the capsule and low uptake in the center, which could be labeled as cold abscess is almost "cold" in FDG PET, which was a unique finding and seems to be explained by the well-established pathological characteristics of tuberculosis "cold abscess." Based on our findings, we suggest that FDG uptake in tuberculosis lesions may vary depending on the grade of inflammatory activity of the lesion.

Apart from the importance of differentiating infection or inflammation from malignancies, these pathologies represent an independent interesting research target of FDG PET. Clinical demand for FDG PET is also emerging especially in patients with fever of unknown origin. Because tuberculosis exhibits a wide variation in disease pattern, knowledge of the FDG uptake patterns in various tuberculosis lesions is important. Our cases showed unique new diagnostic findings of cold abscess; moderate uptake in the capsule and low in the center by FDG PET. These features may be useful for the interpretation of clinical PET images. Further investigation of a larger sample is warranted.

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