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An abnormal accumulation of fluorine-18-FDG PET in cytomegalovirus enteritis—A case report

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The source of a fever of unknown origin (FUO) and watery diarrhea in a 63-yr-old female with a history of disturbance of consciousness due to moyamoya disease was examined. Fluorine-18 fluorodeoxyglucose positron emission tomography (FDG-PET), colonoscopy, blood analysis, and determination of cytomegalovirus (CMV) antigenemia were performed. FDG was found to be accumulated in the wall of a dilated colon, and extended from the transverse to sigmoid colon. Colonoscopy revealed edematous, inflammatory, and punched out lesions in accordance with the areas of abnormal FDG uptake. A biopsy specimen showed the antibody of CMV in the colonic mucosa, and CMV antigenemia was detected by an immunohistochemical assay using a monoclonal antibody for CMV pp65 antigen. From these findings, we strongly suspected CMV enteritis.

Key words: cytomegalovirus enteritis, FDG-PET, fever of unknown origin, consciousness disturbance

INTRODUCTION

CYTOMEGALOVIRUS (CMV) is the most common viral pathogen in patients with an immunocompromised state, including human immunodeficiency virus (HIV) infection, transplantation, and chemotherapy.[1–12] Especially, CMV pneumonitis is the most common, while CMV gastroenteritis is rare and is not well documented. We encountered a patient with CMV enteritis in whom fluorine-18 fluorodeoxyglucose positron emission tomography (FDG-PET) visualized the abnormal accumulation in colon when an attempt was made to determine the origin of the fever of unknown origin (FUO).

To our knowledge, there has been no report about the FDG-PET finding of cytomegalovirus enteritis. This prompted us to report the FDG-PET findings of CMV enteritis in the present case.

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CASE REPORT

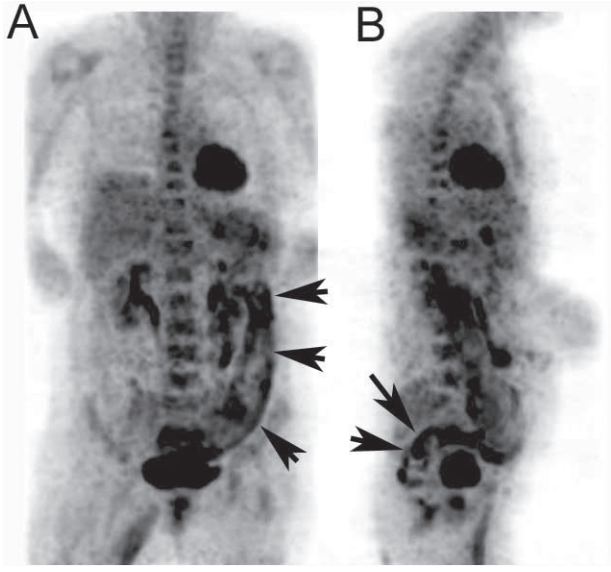
A 63-year-old Japanese female was admitted to a local hospital for medical treatment due to headache and nausea in April of 2004. The conscious level of the patient deteriorated and she was transferred to our hospital for further examination. MRI and cerebrovascular angiography indicated an infarction in the bilateral parietal cortex and moyamoya-like vessels. Therefore, she was diagnosed with moyamoya disease and was scheduled for surgery in the Department of Neurosurgery.

Following admission, she developed a low-grade fever and became dehydrated. At that time, she had a white blood cell (WBC) count of $30.0 \times 10^6/\mu l$, a platelet count of $308 \times 10^6/\mu l$, blood urea nitrogen (BUN) of 49 mg/d*l*, creatinine of 1.3 mg/d*l*, and C-reactive protein (CRP) at 13.0 mg/d*l*. Antibodies to HIV or Hepatitis virus were not detected. Although, cultures of blood, sputum, and urine

were negative, administration of antibiotic (piperacillin) and treatment of the dehydration were performed. However the fever persisted and the clinical condition did not improve. Watery diarrhea occurred on day 19 after admission, and changed to bloody diarrhea on day 25.

On day 23 after admission, FDG-PET was performed to determine the origin of the FUO. An ECAT EXACT HR 47 PET camera (Siemens/CTI) was used, and imaging was performed using 3-D acquisition at 60 minutes after the intravenous administration of 250 MBq ^{18}F-FDG. The collected data were reconstructed into a 128 × 128 pixel image matrix. Tissue attenuation of annihilation photons was corrected by transmission scans using rotating ^{68}Ge/^{68}Ga line sources. Six bed positions of the body trunk were applied, which covered areas from the neck to the pelvis. The total time for one bed position was 6 minutes (min), with a transmission scan of 2 min and an emission scan of 4 min. The patient fasted for at least 6 hours prior to the examination. Normal blood glucose level was confirmed prior to the PET scan. Regional FDG uptake in the affected area was expressed as standardized uptake value (SUV). FDG accumulation was observed in the shape of a belt from the transverse colon to the sigmoid colon, and also showed the colon to be dilated in the same region (Fig. 1a and b). SUV_{max} was approximately 5 in the affected areas. In addition, FDG uptake was increased in bone marrow of thoracic and lumbar vertebrae and inside part of right femur. The scout abdominal CT scan showed an obviousy dilated colon (Fig. 2). Informed consent was obtained from this patient prior to PET scanning.

On day 25, emergency colonoscopy was performed. Endoscopic findings revealed edematous, inflammatory lesions and punched out ulcers in the colonic mucosa, which spread from transverse to sigmoid colon and were in accordance with the abnormal accumulation of FDG-PET (Fig. 3). The sigmoid colon showed the most severely damaged mucosa. However, we were unable to detect any other gastrointestinal disorders. The biopsy specimen from the colonic lesions did not reveal cells with an inclusion body. However, the colonic mucosa was positive for antibodies to CMV, and CMV antigenemia was detected by an immunohistochemical assay using a monoclonal antibody for CMV pp65 antigen.[13] From these findings, we suspected strongly CMV enteritis and began administration of ganciclovir, following which, the symptoms of enteritis were mitigated. After the therapy of CMV enteritis, the patient was treated surgically for moyamoya disease in the Department of Neurosurgery.



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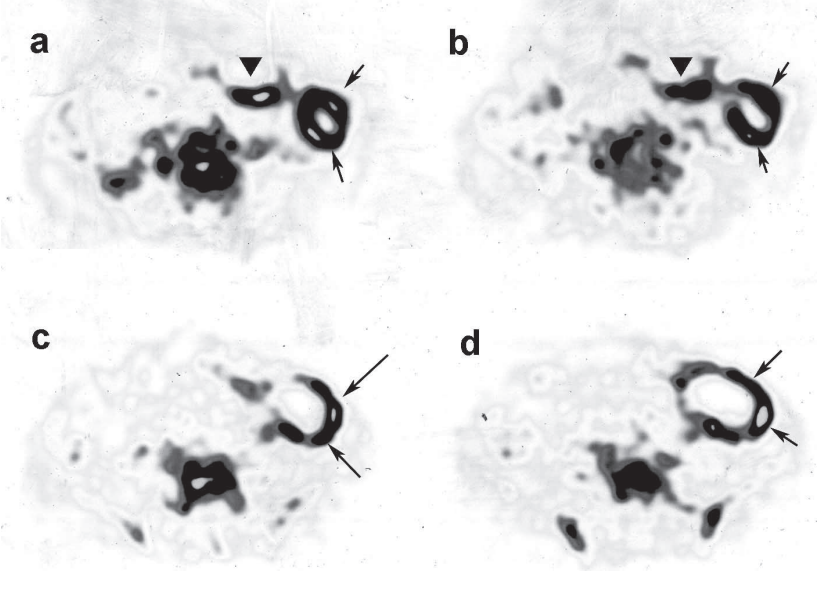

b

Fig. 1 a: Coronal and sagittal FDG-PET images on day 23 are shown. The colon is dilated from the transverse to the sigmoid colon, with marked FDG uptake in the colon wall (SUV = about 5) (*black arrow*). Inflammatory bowel disease was suspected. b: Axial FDG-PET images on day 23 are shown. Images a and b, and, c and d were next to each other in the vertical direction. Especially, c is located from b to 8 cm caudal side. Black arrows show the dilated descending colon and marked FDG uptake, and black head arrows show the transverse colon.

DISCUSSION

Of the CMV diseases, pneumonitis is the most common, while CMV gastroenteritis is rare. Taniwaki et al. reported a patient with CMV enteritis who had no obvious immunocompromised state or other gastrointestinal disorders.[14] However, in many reports, CMV enteritis has been observed in severely immunocompromised patients or those with predisposing disorders such as ulcerative colitis (UC). In general, CMV enteritis has been reported to occur in patients with HIV, immunodeficiency, collagen disease, in patients that have undergone blood stem cell/bone marrow transplantation, chemotherapy, organ transplantation, and in premature infants.[1–12] In the immunocompromised host, syndromes produced by CMV begin with prolonged fever, malaise, anorexia, fatigue, night sweat, and arthralgias. The symptoms of CMV enteritis are various, including, persistent abdominal pain, diarrhea, and bloody stool.[10] Bang et al., reported a case of panperitonitis due to an ileal perforation.[12]

In the present case, the general condition of the patient was poor due to disturbance in the level of consciousness, caused by moyamoya disease. We suggested that this poor condition might have attributed to the accompanying CMV enteritis like in immunocompromised patients.

In FDG-PET, high accumulation of FDG was observed in the area of pathological change seen by endoscopy. In general, FDG accumulates in areas showing inflammatory bowel disease (IBD).[15–19] IBD includes Crohn's disease, UC, ischemic colitis, tuberculosis colitis, infectious enteritis, pseudomembranous colitis, collagen accumulation colitis, eosinophilic colitis, and antibiotic-associated colitis. In patients with IBD, FDG is accumulated along the intestinal tract, which is distinct from the pattern of accumulation in a patient with cancer, but the degree of the accumulation has been reported to be not as high.[20,21] We suggest three possibilities concerning the mechanism of FDG accumulation in the intestinal wall. First, the accumulation is increased in inflammatory cells. Second, due to the inflammatory change, there is an increased wall motion of the intestinal tract, which leads to the uptake of FDG. Third, a combination of the first and second possibilities may explain the increased FDG uptake.

The diagnosis of CMV enteritis should be confirmed by various examinations, including diagnostic imaging, fiberscopy, biopsy, blood analysis, CMV antigenemia, and the clinical course. It is impossible to diagnose CMV

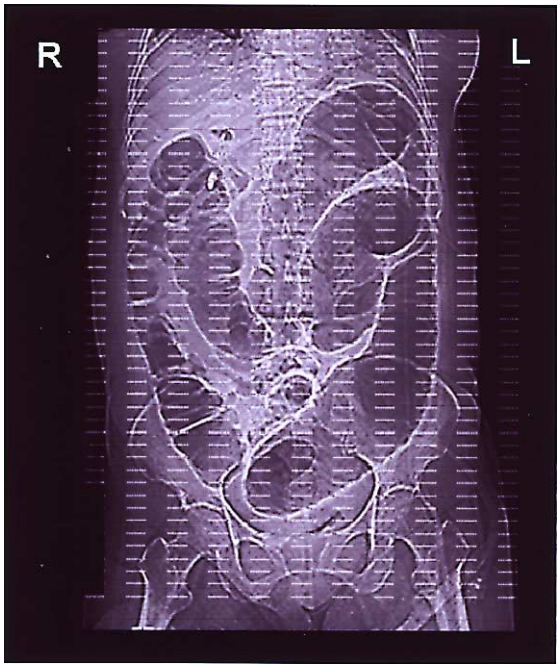

Fig. 2 An X-ray CT scout image obtained on day 23 was shown. A dilated length of colon is evident.

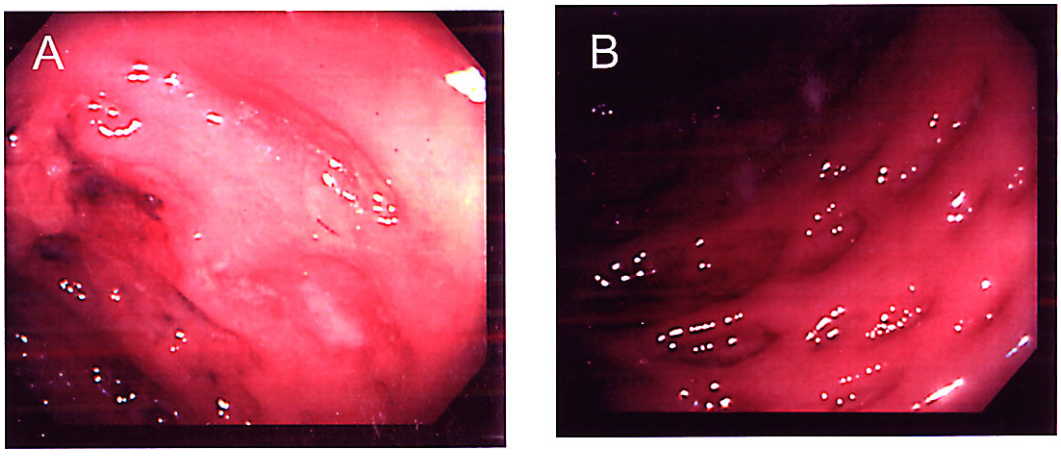

Fig. 3 Images obtained on day 25 by emergency colonoscopy. Edematous, inflammatory lesions and punched-out ulcers are observed from the transverse colon to the sigmoid colon. The sigmoid colon shows the most severe damage.

enteritis only by imaging methods. In the present case, FDG-PET was helpful to detect the abnormalities in the colon. Lorenzen et al. showed that FDG whole-body PET appeared to be a promising diagnostic tool in patients with FUO, when the diagnosis was not conclusive using conventional diagnostic tools.[22]

We observed the uptake in bone. We considered two possibilities about this. First, there was a possibility of a leukemoid reaction, due to severe inflammatory reaction, and therefore, proliferation of the bone marrow might occur. Second, the degenerative change might be related to the uptake. In the present case, the uptake of the bone marrow was inhomogeneous in the entire vertebral body. We thought that the first possibility was plausible.

The reason why the uptake of the inside of right femur increased was considered to be urine contamination.

When FDG-PET demonstrates an abnormal accumulation along with the intestinal wall in patients with FUO, CMV enteritis should be considered as a possiblities in the initial differential diagnosis, especially in the case of patients with HIV or other immunosuppressing condition.

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