**INTRODUCTION**

Vasculitis is defined as inflammation and necrosis with leukocytic infiltration of the vessel wall. Reactive pathological damage to the wall and surrounding tissues is also seen (1). Some patients with vasculitis present with non-specific symptoms such as fever or elevated inflammatory markers. FDG-PET/CT clearly demonstrated intense FDG uptake in vessel walls. A 72-year-old female patient with a one month history of pyrexia had abnormal laboratory data suggesting an inflammatory process. FDG-PET/CT was very useful for the diagnosis of vasculitis. Steroid therapy was introduced. Normalization of laboratory data and symptomatic improvement correlated with normalization of FDG uptake in the vessels. J. Med. Invest. 54 : 345-349, August, 2007

**CASE REPORT**

FDG-PET/CT for diagnosis and follow-up of vasculitis

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Abstract: We report three cases of vasculitis evaluated by FDG-PET/CT. Vasculitis is defined as inflammatory changes and necrosis in the arterial wall. The patients presented with non-specific symptoms such as fever or elevated inflammatory markers. FDG-PET/CT clearly demonstrated intense FDG uptake in vessel walls. A 72-year-old female patient with a one month history of pyrexia had abnormal laboratory data suggesting an inflammatory process. FDG-PET/CT was very useful for the diagnosis of vasculitis. Steroid therapy was introduced. Normalization of laboratory data and symptomatic improvement correlated with normalization of FDG uptake in the vessels. J. Med. Invest. 54 : 345-349, August, 2007

**Keywords**: FDG-PET/CT, vasculitis, arteritis, inflammation, therapy monitoring

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CASE REPORTS

Case 1 (Fig. 1)
A 77-year-old female with heart failure was admitted to our hospital. She had low blood pressure in her upper extremities bilaterally and elevated CRP (4.1 mg/dl, normal < 0.3 mg/dl). $^{67}$Ga-citrate scintigraphy did not show any abnormal finding. FDG-PET/CT did not show any abnormal finding. FDG-PET/CT scan demonstrated intense FDG uptake in the walls of the thoracic aorta, abdominal aorta, carotid arteries and iliac arteries. Contrast-enhanced CT images showed thickened vascular walls. Stenosis of the subclavicular arteries caused the low blood pressure in her arms. Large-vessel vasculitis was confirmed by laboratory data and FDG-PET/CT and CT findings. Steroid therapy was started. On follow up CT, thickened wall remained and inflammatory markers were unstable.

Case 2 (Fig. 2)
A 72-year-old female presented with a one month history of fever. Laboratory tests showed elevated C-reactive protein (CRP) of 12.63 mg/dl and erythrocyte sedimentation rate (ESR) of 40 mm/h (normal range 3-15 mm/h). The diagnosis of vasculitis was confirmed by PET/CT and 30 mg/day of prednisolone (PSL) was started. One month later, symptoms had improved and abnormal uptake in the arterial wall disappeared on repeated FDG-PET/CT.

Case 3 (Fig. 3)
A 32-year-old female was referred with an 8-month history of fever of unknown origin (FUO). She presented with general fatigue and elevated inflammatory markers (CRP 5.1 mg/dl, ESR 70 mm/h). FDG-PET/CT showed increased FDG uptake in the thoracic aorta and its branches (brachiocephalic artery and carotid arteries), which suggested vasculitis and contrast-enhanced CT was recommended. Contrast-enhanced CT demonstrated thickened arterial wall, corresponding to intense FDG uptake. These clinical findings confirmed the diagnosis of vasculitis. Her symptoms improved and laboratory data normalized with the administration of steroids. On follow up CT, no remarkable change was seen in thickened arterial wall.

Fig. 1. A 77-year-old female. a) $^{67}$Ga-citrate scintigraphy shows no abnormal uptake. b) MIP image of FDG-PET. c) MPR image of PET/CT. FDG-PET/CT scan demonstrated intense FDG uptake in the walls of the thoracic aorta, abdominal aorta, carotid arteries and iliac arteries.
Fig. 2. A 72-year-old female. a) FDG-PET image. The diagnosis of vasculitis is confirmed. b) FDG-PET image after steroid therapy. Abnormal uptake in the arterial wall disappeared on repeated FDG-PET.

Fig. 3. A 32-year-old female. a) Coronal view of FDG-PET. b) Axial view of FDG-PET. c) Axial view of PET/CT image. FDG-PET/CT shows increased FDG uptake in the thoracic aorta and its branches (brachiocephalic artery and carotid arteries).
DISCUSSION

Vasculitis is classified into three types according to vessel size. The common large-vessel vasculitides are giant cell arteritis (GCA) and Takayasu disease. Large-vessel vasculitis is considered to be the cause in about 17% of all FUO patients (3, 4). $^{67}$Ga-citrate had been considered to be a good tracer to investigate these patients, but the spatial resolution of $^{67}$Ga scintigraphy is not sufficient. One of our patient was examined by $^{67}$Ga scintigraphy, which showed no abnormal uptake in the arterial walls. Blockmans first reported the use of FDG-PET to investigate GCA patients (5). FDG accumulates in inflammatory tissue due to the over-expression of glucose transporter (GLUT, mainly GLUT-1, 3) and over-production of glycolytic enzymes in inflammatory tissue. FDG-PET is highly effective in detecting vasculitis anywhere in the body and has high sensitivity (77-100%) and specificity (89-100%) (6-10). If using PET-alone system, FDG uptake are often considered to be equivocal because of the lack of anatomical localization. There have been some literatures that reported coregistration of PET and contrast-enhanced CT images with image fusion software (8, 11). Intense FDG uptake clearly correlated with thickened and well-enhanced arterial wall on CT. Meller, et al. reported that FDG-PET images identified more vascular regions than MRI did (12). The misregistration of metabolic and anatomic images is sometimes problematic. In our cases, we could evaluate both the activity of arterial inflammation and anatomical localization with minimal misregistration using PET/CT system.

Assessment of the response to therapy has a central role in patient management. For the patients with vasculitis, ESR or CRP is commonly used to assess response to steroid therapy. CT and MRI frequently show residual abnormal findings even after symptoms have completely resolved and sometimes show discrepancies with laboratory data. FDG accumulation in the arterial wall reflects vasculitis activity, and correlates well with blood inflammatory markers. In our follow up PET/CT examination, normalization of FDG uptake clearly correlated with clinical improvement and normalization of laboratory findings. Some patients with vasculitis have non-specific symptoms and proper diagnosis at an early stage with PET/CT allows early treatment, which will lead to a better patient outcome.

PET/CT has the potential to diagnose and monitor the response to therapy both in malignant tumors and inflammatory diseases by integrating anatomic and metabolic images.

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