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Abnormal accumulation of [^{18}F]fluorodeoxyglucose in the aortic wall related to inflammatory changes: three case reports

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We present 3 cases with abnormal accumulation of FDG in the aortic wall. Their clinical manifestations were vague or asymptomatic, and laboratory data were consistent with inflammatory reaction. These 3 patients were diagnosed with Takayasu arteritis, inflammatory aortic aneurysm (IAA), and retroperitoneal fibrosis (RF), respectively. FDG-PET and CT images showed the intense FDG uptake corresponding to the arterial walls and/or the soft tissue density surrounding the artery. It was deduced that FDG was probably taken up by inflammatory cells which infiltrated the arterial walls and/or the soft tissue mass. These cases indicated that FDG-PET is a useful method for localization of inflammatory lesion in patients with unspecific clinical findings and laboratory data.

Key words: Takayasu arteritis, inflammatory aortic aneurysm, retroperitoneal fibrosis, FDG, inflammation

INTRODUCTION

FDG-PET imaging has played an important role in the diagnosis of various malignant tumors. Increased glucose transporter protein (GLUT) expression in various malignant tumors has been reported and it is suggested that increased GLUT expression contributes to increased FDG uptake in PET imaging.[1–5]

Increased FDG uptake, however, is also observed in various kinds of inflammatory lesions,[6,7] which suggests that FDG-PET imaging can be useful in localizing inflammatory lesions in patients who show unspecific general inflammatory and infectious findings.[8–13]

In this report, we show three cases with FDG uptake in the arterial wall. The common features of these three cases provide insight into the pathological changes that contribute to intense FDG uptake and enhance the usefulness for diagnosis of inflammatory diseases.

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FDG-PET protocol

Fluorine-18-labeled deoxyglucose (FDG) positron emission tomography (PET) scan of the whole body was performed after a 6-hour fast. The scans started 60 minutes after FDG injection at a dose of 296 MBq. Images were reconstructed with OSEM methods.

CASE REPORTS

Case 1

A 57-year-old woman presented with a 3-month history of fever, dizziness and cough. The patient was initially treated with an antifebrile; however, her condition did not improve. At the time of her presentation at our facility, she had persistent elevation of C-reactive protein (CRP; 8.8 mg/d*l*), an accelerated erythrocyte sedimentation rate (ESR; 116 mm), and elevated IL-2R (589 U/m*l*). P-ANCA, C-ANCA and rheumatoid factors were negative. Complement levels were slightly elevated. FDG-PET scan showed increased FDG uptake in the thoracic and abdominal aortic wall, and the uptake continued to the main branches of the thoracic aorta (Fig. 1a, b, d). A contrast-enhanced CT scan was taken 2 weeks after the FDG-PET scan and demonstrated thickening of the aortic wall (Fig. 1c). The localization of her inflammation in the arterial wall by FDG-PET yielded a diagnosis of Takayasu

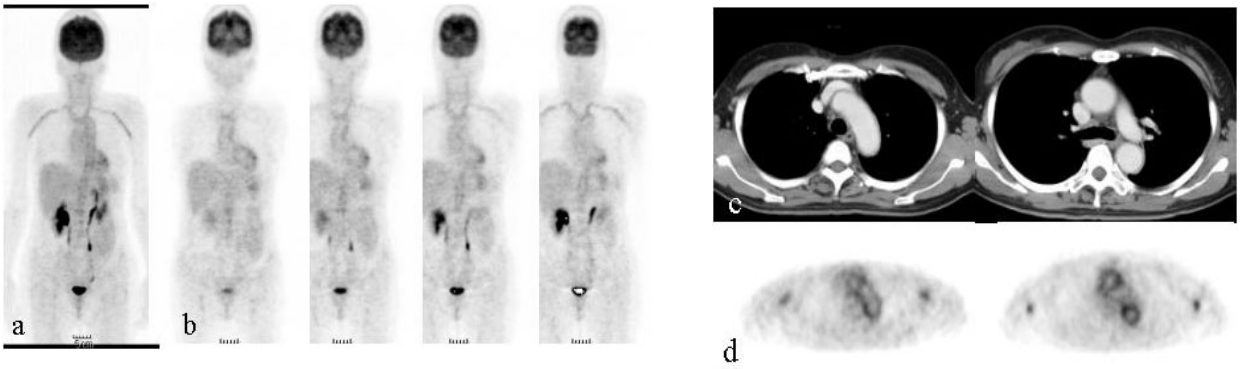

Fig. 1 a, b: FDG-PET images show continuing uptake in the thoracic abdominal aorta, brachiocephalic artery, common carotid arteries, and subclavian arteries. (a, maximum intensity projection (MIP); b, coronal view.) c, d: CT images demonstrate aortic wall thickening (c). Intense abnormal FDG accumulation is noted in the aortic wall (d). (c, contrast-enhanced CT; d, FDG-PET axial views corresponding to the CT images.)

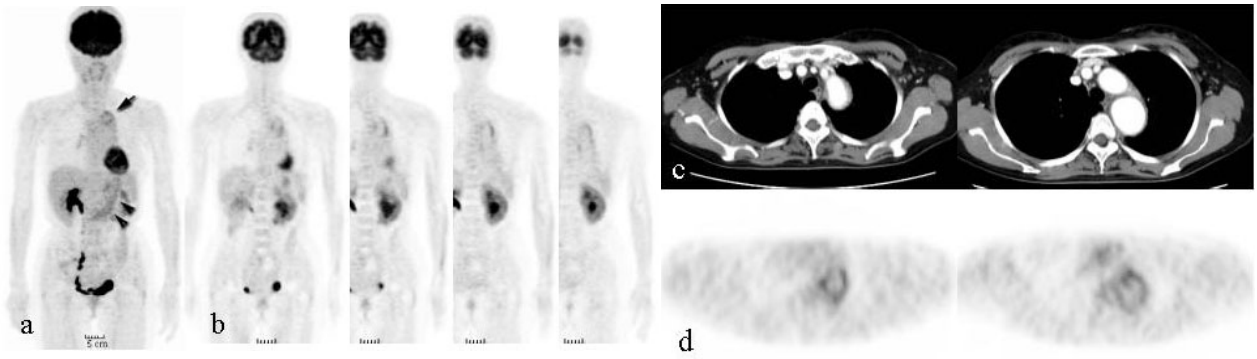

Fig. 2 a, b: FDG-PET images demonstrate abnormal FDG accumulation in the aortic arch. Moderate diffuse uptake is seen in the stomach (*arrowhead*). No other abnormal FDG uptake is seen. c, d: CT images show a dilated thoracic aorta with wall thickening. FDG-PET demonstrates intense uptake corresponding to the aneurysmal wall. (c, contrast-enhanced CT; d, FDG-PET axial views corresponding to the CT images.)

arteritis. The diagnosis was confirmed by laboratory data and improvement of her symptoms with the administration of steroids.

Case 2

A 54-year-old female underwent an FDG PET scan to determine the possibility of an underlying residual malignant lesion and distant metastasis at 4 years after liver surgery for rectal cancer metastasis. FDG-PET showed intense uptake of FDG in the aortic arch, and no other abnormal findings were seen (Fig. 2a, b). CT showed a dilated aortic arch and wall thickening, corresponding to the intense uptake area on FDG PET (Fig. 2c, d). At the time of the FDG-PET scan, her CRP was 1.5 mg/d*l*. She had not complained of any inflammatory symptoms, such as abdominal or back pain. After excluding possible primary causes, diagnosis of inflammatory aortic aneurysm was confirmed by typical radiological findings, namely a thickened and dilated aneurysmal wall with enhancement on contrast-enhanced CT.[14]

Case 3

A 56-year-old male was referred to hospital for abdominal pain. He received antibiotics initially; however, his symptoms did not improve. CT showed abdominal aortic wall thickening surrounded by soft tissue density. The soft tissue density was enhanced and extended to the adjacent structures. His laboratory data showed slightly elevated C-reactive protein (CRP; 1.5 mg/d*l*) and an accelerated erythrocyte sedimentation rate (ESR; 43 mm). He was diagnosed with retroperitoneal fibrosis based on his clinical and radiological findings. FDG-PET demonstrated abnormal accumulation of FDG around the abdominal aorta (Fig. 3a, b), and the intense uptake of FDG corresponding to the arterial wall and the soft tissue densities on his CT (Fig. 3c, d).

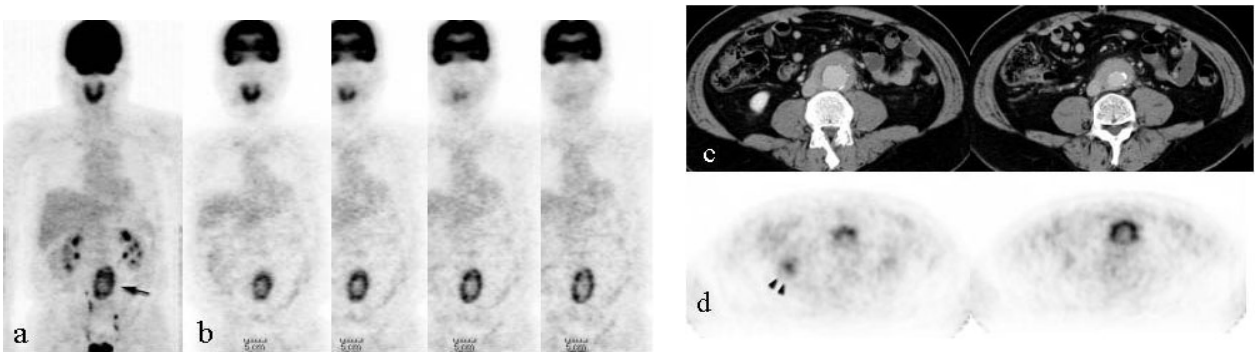

Fig. 3 a, b: FDG-PET shows intense FDG uptake surrounding the abdominal aorta. c, d: CT images show a soft tissue density area around the abdominal aorta and expanding to the inferior vena cava. Axial view of FDG-PET demonstrates intense FDG accumulation corresponding to soft tissue density. Normal physiologic radioactivity is also seen in the right kidney (*arrowhead*). (c, contrast-enhanced CT; d, FDG-PET axial views corresponding to the CT images.)

DISCUSSION

We experienced 3 cases in which FDG uptake was shown in aortic walls. All FDG-PET scans started 60 minutes after the injection. It is reported that the amount of activity remaining in the circulation after this time is minimal.[15] Therefore, the FDG uptake in the aortic wall suggested increased glucose metabolism due to pathological processes.

After administration, FDG is transported into glucose-consuming cells, metabolized by hexokinase, and accumulated. FDG accumulation is not specific for malignant tumors. Recent investigations have reported increased accumulation of FDG in inflammatory lesions. Mochizuki et al. reported that GLUTs expression was detected by immunohistochemical study in inflammatory tissue, and the inflammatory tissue showed [^{14}C]FDG uptake higher than that of normal control muscle.[16] Therefore, FDG accumulation in the aortic wall suggested the existence of an inflammatory condition.

In Takayasu arteritis, the histological signs are focal dissection and infiltration with epithelioid cell granulomas and focal lymphoplasmocellular infiltration of the adventitia and the peripheral layers of the media.[17] The inflammation, whose etiology is still unknown, primarily involves the aorta and its major branches.[18] Idiopathic retroperitoneal fibrosis (IRF) and inflammatory aortic aneurysms (IAA) include chronic periaortitis, which is a spectrum of idiopathic disease characterized by a fibroinflammatory reaction. Histological signs of the chronic periaortitis are inflammatory infiltrate of the aortic adventitial and retroperitoneum. In IRF, the aorta is undilated and the retroperitoneal fibroinflammatory tissue may or may not involve neighboring structures; in IAA, the mass develops around a dilated aorta and usually does not cause obstructions. Inflammatory changes are found in all chronic periaortitis, regardless of the presence of aneurysmal dilatation.[19]

In our cases, FDG was probably taken up by inflammatory cells which infiltrated the aortic walls and/or the soft tissue density around the artery. The higher accumulation demonstrated the distribution of inflammatory cells, and probably correlated with the grade of inflammatory activities. Meller et al. suggested that FDG-PET was more reliable than MRI in monitoring disease activity of aortitis during immunosuppressive therapy.[20]

Takayasu arteritis and chronic periaortitis have a chronic-relapsing course and usually progress. As these diseases progress, arterial stenosis or the involvement of adjacent structures may occur. The severe complications of IAA or RF can be associated with eventual rupture. Early diagnosis is important for the proper initiation of treatment and can avoid these complications and manifestations.[21] In RF, FDG-PET can help to detect the presence of active inflammatory foci in the residual mass at the time of disease relapse. We could identify inflammatory lesions in the arterial wall of patients who showed unspecific inflammatory symptoms, even in an asymptomatic state. Therefore, FDG-PET has been proposed as a useful tool for the detection of inflammatory changes in the arterial wall.

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