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【 CASE REPORT 】

Diffusion Weighted Whole Body Imaging with Background Body Signal Suppression (DWIBS) Was Useful for the Diagnosis and Follow-up of Giant Cell Arteritis

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Abstract:
A 66-year-old woman with symptoms of fatigue and headache was diagnosed with giant cell arteritis (GCA). Fluorodeoxyglucose (FDG)-positron emission tomography (PET)/computed tomography (CT) revealed the strong accumulation of FDG in the descending aorta, abdominal aorta, bilateral subclavian artery, and total iliac artery. Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) showed signal enhancement at the descending aorta and abdominal aorta. We repeated FDG-PET and DWIBS 2 months after the initiation of therapy with prednisolone. In line with the FDG-PET findings, the signal enhancement of the aortic wall completely vanished on DWIBS. DWIBS may be a novel useful tool for the diagnosis and follow-up of GCA treatment.

Key words: giant cell arteritis, diffusion weighted whole body imaging with background body signal suppression (DWIBS), positron emission tomography (PET)

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Introduction

Giant cell arteritis (GCA) is defined as large-vessel arteritis, often granulomatous and usually affecting the aorta and/or its major branches, with a predilection for the branches of the carotid and vertebral arteries. To prevent serious ischemic complications, such as visual loss, in patients with GCA, an early diagnosis is essential. To achieve this, early imaging tests are highly recommended (1). Diffusion-weighted whole-body imaging with background body signal suppression (DWIBS) is a relatively new imaging modality (2). Based on the European League Against Rheumatism (EULAR) recommendations for the use of imaging in the assessment of large vessel vasculitis (LVV) in the clinical setting, ultrasound, positron emission tomography (PET), MRI and/or computed tomography (CT) are recommended for the diagnosis (1).

DWIBS is based on diffusion-weighted imaging, which visualizes and assesses the random movement of water at the molecular level, and allows for the acquisition of volumetric diffusion-weighted imaging (DWI) of the whole body without radiation exposure (2).

Although this modality obtains images by a completely different mechanism, it is reported to show similar findings to fluorodeoxyglucose (FDG)-PET in the evaluation of cancer patients (3), with no radiation exposure, and at a much lower cost (1/5 of the cost of FDG-PET in Japan). We report the case of a patient with GCA in which signal enhancement at the aortic wall was clearly detected by DWIBS, similarly to PET. Moreover, the uptake and signal enhancement vanished after treatment. This case suggests

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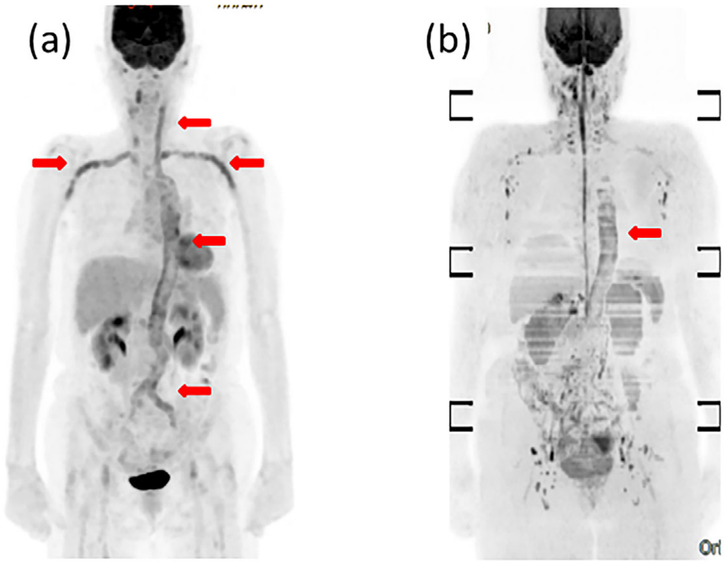

Figure 1. Coronal images of FDG-PET/CT before the treatment of GCA, FDG accumulation is observed in descending Aorta, Abdominal aorta, bilateral subclavian artery, and total iliac artery (a). High signal is also observed in DWIBS image as well (b). Signal uptake or enhancement was pointed by red arrow. FDG-PET/CT: fluorodeoxyglucose- positron emission tomography/computed tomography, DWIBS: diffusion-weighted whole-body imaging with background body signal suppression

that DWIBS is novel useful tool for the diagnosis and follow-up of patients with GCA. This is the report on the successful application of DWIBS in the evaluation of disease activity in a patient with GCA.

Case Report

A 66-year-old woman presented to our hospital with fatigue, and headache. Her C-reactive protein (CRP) level was 8.2 mg/dL and her erythrocyte sedimentation rate (ESR) was 115 mm/h. The patient had a history of acute T cell lymphoma (ATL). A hematologist in our hospital initially suspected a recurrence of ATL and ordered PET. FDG-PET/CT revealed strong the accumulation of FDG in the descending aorta, abdominal aorta, and total iliac artery. The standardized uptake max (SUVmax) was 6.1 and the accumulation of FDG was observed in the common carotid artery, left superficial temporal artery and bilateral subclavian artery (SUV max 4.3, 4.0, and 5.8, respectively) (Fig. 1a, Fig. 2a).

The patient was referred to the division of rheumatology in our hospital. We also conducted DWIBS and found signal enhancement at the aorta, abdominal aorta, and total iliac artery; however, the signal was unclear in comparison to the uptake observed on FDG-PET (Fig1 b, Fig2 b). To diagnose the patient, we conducted a biopsy of the temporal artery. A pathologic examination showed granulomas associated with the appearance of multinucleated giant cells, and no evidence of recurrent ATL. She met the American College of Rheumatology criteria (1990) for GCA (4). Oral prednisolone (PSL) was started at a dose of 50 mg. At 10 days after treatment, her CRP level had decreased to 0.17 mg/dL, and the patient didn't show fatigue (Fig. 3).

We performed FDG-PET and DWIBS again at 2 months after the initiation of therapy. Surprisingly, as was observed on FDG-PET, the signal enhancement of the aortic wall had completely vanished on DWIBS (Fig. 4). The PSL dose was decreased to 20 mg/day. No recurrence has been detected to date.

Discussion

The present case showed the clear signal of the aortic wall on DWIBS. After treatment the signal completely disappeared. Imaging modalities, including ultrasound (US), MRI, CT and ^{18}F-FDG PET currently play a very important role in the diagnosis of GCA (1). DWIBS is form of diffusion-weighted magnetic resonance imaging (DWI). Previously DWI was only used for the brain. Extracranial DWI did not become a clinical standard because the use of echo-planar imaging was complicated by magnetic susceptibility artifacts and severe image distortion in the body. With DWIBS, this problem associated with extracranial DWI has been largely overcome. This technique intentionally uses free breathing scanning rather than breath-holding or respiratory triggering to visualize (moving) visceral organs and their lesions (3). Thus, the information obtained by DWIBS overlaps with conventional MRI information. The image obtained by DWIBS is unclear, and more time is needed to obtain images in comparison to MRI. However, DWIBS can obtain a whole body image and can identify very small changes of density.

Ultrasound of the temporal arteries is recommended as the first choice of imaging modality for patients in whom predominantly cranial GCA is suspected; however, this im-

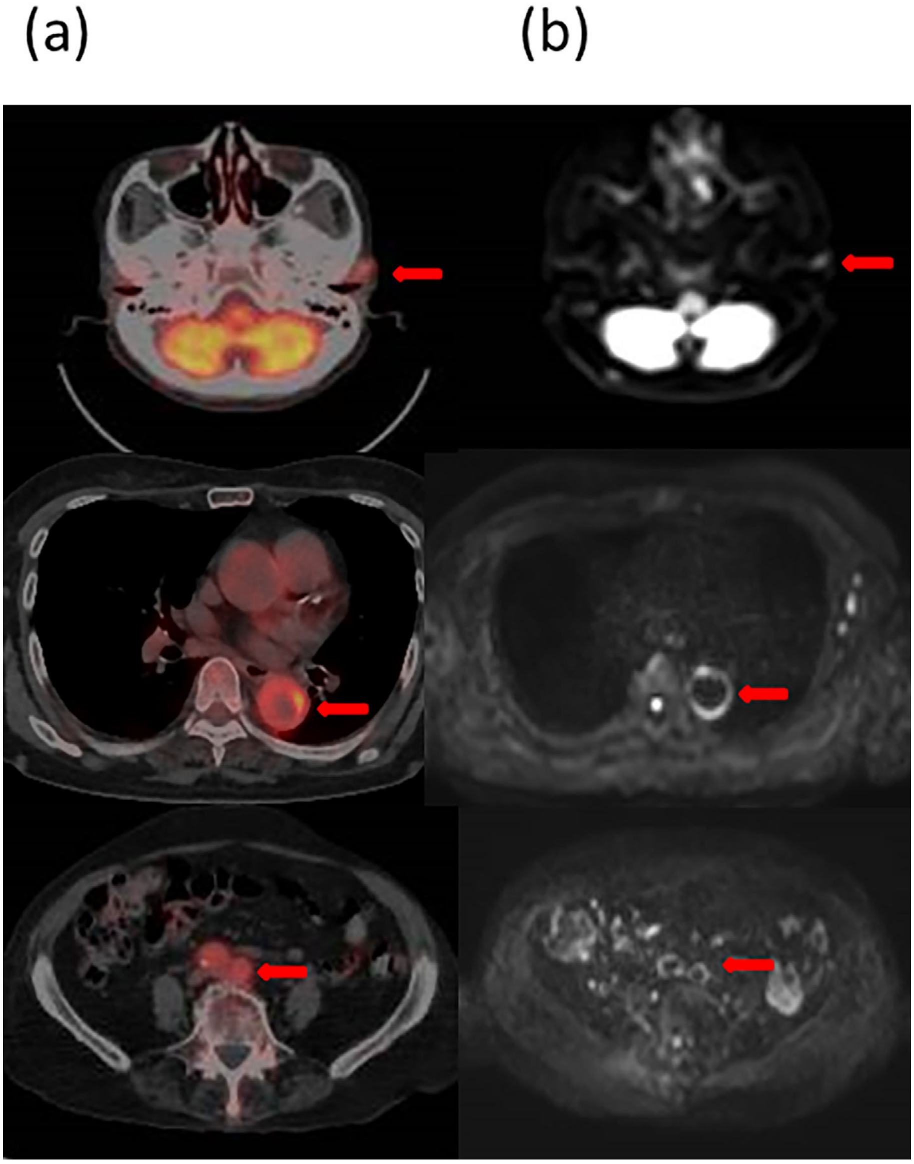

Figure 2. **Axial images of FDG-PET/CT (a) and DWIBS image as well (b). Signal uptake or enhancement was pointed by red arrow.**

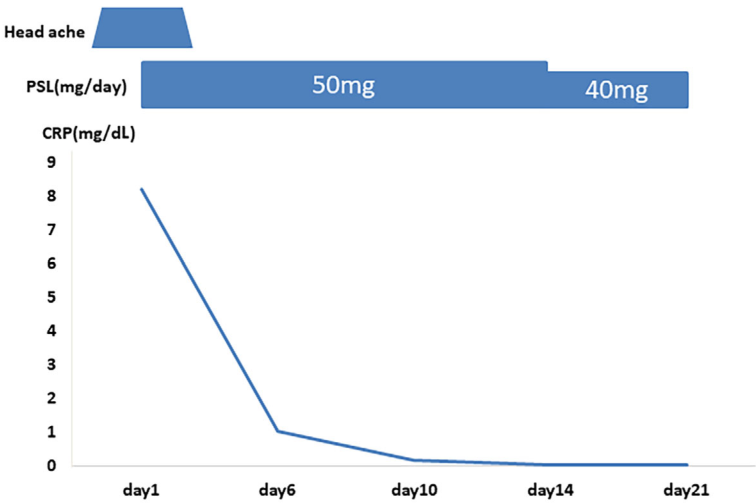

Figure 3. **Clinical course of the patient. CRP: C-reactive protein, PSL: prednisolone**

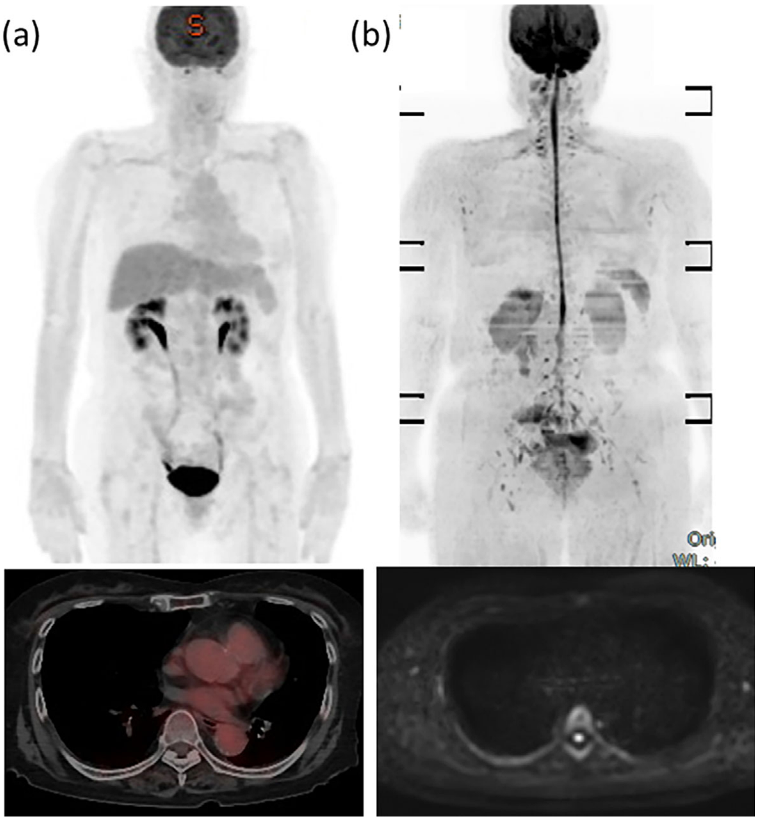

Figure 4. **In FDG-PET/CT images after the treatment of GCA, FDG accumulations on the all are vanished. (a). High signal shown previously was also vanished in DWIBS image as well (b).**

aging modality is unsuitable for diagnosing large vessel-GCA (LV-GCA). The diagnosis of LV-GCA is often challenging because the symptoms of LV-GCA are often vague, and temporal artery biopsies are often negative. In these cases FDG-PET/CT is very useful. However, FDG-PET/CT is exposes the patient to radiation, and is expensive to perform (approximately $1,000 in Japan). In this case, DWIBS showed similar results to FDG-PET/CT. However, the images of the abdominal aorta, subclavian arteries, carotid arteries, and iliac arteries obtained by DWIBS were not as clear as those obtained by FDG-PET/CT. There have been no studies to compare the sensitivity DWIBS and FDG-PET/CT in the diagnosis of GCA. However, several studies have suggested that DWIBS has lower sensitivity than FDG-PET/CT in the diagnosis of cancer (5-7). Thus, DWIBS might also have lower sensitivity than FDG-PET/CT in the diagnosis of GCA. However, from the viewpoints of cost and side effects, DWIBS is more beneficial than FDG-PET/CT. In DWIBS, the patient is not exposed to radiation or contrast agent, and costs approximately $160 in Japan.

Because GCA often result in aortic stenosis, occlusion, and rupture despite the absence of ongoing clinical activity (8), imaging follow-up seems very important. However, based on the EULAR recommendations on the use of imaging in LVV, follow-up imaging is not recommended because a PET signal remains in up to two-thirds of patients in full clinical remission (9), and although ultrasound studies in GCA have reported the disappearance of the 'halo sign' in the temporal arteries after 2-4 weeks of PSL therapy (10, 11), residual changes of the extracranial arteries often remain visible for several months.

In our case, the signal enhancement around the aortic walls rapidly disappeared after PSL treatment; thus, DWIBS was also useful for the follow-up of GCA activity. Moreover, the cost of DWIBS is low and it is not associated with the risks of radiation exposure and contrast agent usage. Although few reports have suggested the utility of DWIBS in the diagnosis of large vessel vasculitis, including GCA, we consider DWIBS to have good potential for the evaluation, diagnosis, and follow-up of large vessel vasculitis.

The authors state that they have no Conflict of Interest (COI).

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