Case Report

$^{18}$F-FDG PET/CT in the diagnosis of Takayasu arteritis: A case report✩✩

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**A B S T R A C T**

The early clinical symptoms of Takayasu arteritis (TAK) are nonspecific and often lead to misdiagnosis or delay in diagnosis. And by the time morphological changes are observed on the images, the disease is in an advanced stage and irreversible vascular injuries has occurred. Therefore, early correct diagnosis and timely systemic anti-inflammatory treatment can effectively improve the clinical situation. Conventional imaging provides only changes in vascular structure and provides little information on inflammatory activity. Here we report the PET/CT imaging presentation of 18F-deoxyglucose ($^{18}$F-FDG) in a patient with TAK, a 58-year-old patient with known TAK whose disease clustered many non-specific features, and highlight the value of PET/CT in the diagnosis and management of patients with early or atypical clinical presentation of TAK.

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**Introduction**

TAK is a chronic progressive granulomatous vasculitis of unknown etiology, mainly involving the aorta and its major branches, possibly also the coronary and pulmonary arteries. TAK is rare and most common in young Asian women [1]. The clinical manifestations of AKT in the 2020 European League Against Rheumatism (EULAR) guidelines on the treatment of AKT include new or worsening limb lameness, physical symptoms (weight loss >2kg, low-grade fever, fatigue, night sweats), myalgia, arthralgia, arthritis, severe abdominal pain, stroke, seizures (non- hypertensive), syncope, dizziness, tetraplegia, myocardial infarct, angina, acute visual symptoms etc.[2] Clinical features varies according to the location and severity of the involved arteries, and Patients with characteristic appearances can be diagnosed by the above clinical features. However, most patients with TAK show hidden subacute clinical features, mainly early non-specific signs and systemic symptoms, which are similar to those of other diseases, leading to a delay in early diagnosis and irreversible vascular damage by the time of diagnosis.

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This makes early diagnosis and timely treatment of TAK challenging.

The latest EULAR recommendation is that the diagnosis of some suspected large vessel vasculitis (LVV) should be confirmed by imaging or histology [2]. Angiography has always been the gold standard for the diagnosis of TAK, which can show lumen changes caused by vasculitis, such as stenosis or occlusion, but there are some risks such as allergic reactions, hematoma, iatrogenic embolism and arterial dissection [5]. US, CTA and MRA have been gradually used in the assessment of TAK and have some diagnostic value. However, these imaging methods can only show abnormal vascular morphology, such as stenosis, thickening, edema, etc.; these changes usually appear in the late stage of TAK. TAK is a typical inflammatory process, characterized by granulomatous inflammation in the early stage, involving the inner wall, without affecting the external vessel, and then developing to the change of vascular morphology in the late stage of the disease, they provide little information on early inflammatory activity in TAK patients. There is an urgent need for high sensitivity and specificity tools for quantitative analysis of vascular inflammation. 18F-FDG PET/CT is a functional imaging technique commonly used for the diagnosis and staging of tumors and has also shown a role in the field of inflammatory diseases.

Case description

Patient, female, 58 years old, complained of weakness for 2 months. The patient presented to the local hospital 3 months ago with no apparent cause for weakness and panic and shortness of breath after activity, with wasting, night sweats, neck, shoulder and back muscle pain and stiffness, without fever. Blood count: total white blood cell count 6.1*10^9/L (4.0-10.0*10^9/L), hemoglobin 88g/L (110-150g/L), neutrophil count 4.27*10^9/L (1.8-6.3*10^9/L), platelet count 480*10^9/L (148-257*10^9/L); thyroid hormone levels are normal; no abnormal liver and kidney function, treatment with physiotherapy, lipid regulation and herbs to promote hemoglobin showed no significant improvement. Erythrocyte sedimentation rate (ESR) was 142 mm / h (0-20 mm / h); no abnormal autoimmunity. She came to our hospital for definitive diagnosis and treatment, after admission examination: anemia appearance; blood routine: moderate anemia; ferritin and C-reactive protein (CRP) increased; no occupying lesions or lymph node enlargement on chest and abdomen CT; common tumor markers normal. 18F-FDG PET/CT imaging for differential diagnosis of tumorous diseases.

Fig. 1 – 18F-FDG PET/CT image of a patient with AKT (female, 58 years old) (arrows indicate the location of the lesion). A. PET maximum density projection map showing the continuation of the lesion from the aortic root to the level of the abdominal arterial bifurcation. B. CT showing thickening of the aortic wall. C–E. Cross-sectional, coronal and sagittal PET/CT fusion images show a diffuse increase in metabolism in the involved vascular wall.

The 18F-FDG PET/CT image (Fig. 1) shows a diffuse thickening of the aortic wall and a heterogeneous increase in the distribution of radioactivity, with a significant increase in the descending aorta and a maximum standardized uptake value (SUV\textsubscript{max}) of 6.1. The lesion continues from the root of the aorta to the level of the bifurcation of the abdominal artery, involving upwards the cephalic trunk, right common carotid, right subclavian, left common carotid and left subclavian arteries. Diffuse wall thickening and increased metabolism in the large vessels of the aorta and branches of the superior arch. Combined with the typical location and range of involvement, TAK is considered to be more likely. Give prednisone tablets 50mg once a day. Aspirin enteric-coated tablets 100 mg
orally, once a day. After treatment, the mental state of patients was significantly improved, ESR decreased to 14 mm / H, CRP decreased to 1.62 mg / L.

**Discussion**

The characteristic pathological feature of TAK is vascular inflammation, and given the increased FDG uptake by inflammatory cells, 18F-FDG PET/CT can show the inflammatory state of the vessel wall before morphological abnormalities are identified by CT and MRI, contributing to the early diagnosis and assessment of TAK [6].

The EULAR guidelines, updated as early as 2018, suggest that PET may be of some value in patients with non-specific symptoms and that CT (also used in combination with PET) can visualise changes in the vessel wall and lumen and can be widely used [5]. Guidelines for the use of 18F-FDG PET/CT in large vessel vasculitis (LVV), published jointly by the European Medical Association, the Society of Nuclear Medicine and Molecular Imaging and the PET Group in 2018 [7], the guideline recommends the use of a standardized 0-3 grading system: 0 = no uptake (< mediastinum); 1 = low uptake (< liver); 2 = moderate uptake (= liver), 3 = high uptake (> liver), grade 0 and 1 are negative, level 2 suggested the possibility of LVV, and level 3 suggested that LVV activity was positive. In a retrospective analysis of the clinical data of 22 patients with TAK by Fan et al., PET/CT evaluated TAK with a sensitivity of 100.0%, a specificity of 75.0%, a positive predictive value of 87.5% and a negative predictive value of 100.0%. This indicates that PET/CT has unique diagnostic value for TAK with atypical clinical presentation and is useful in assessing disease activity [8].Our case highlights the unique role of PET/CT in patients with early non-specific signs of TAK, particularly in patients with unclear inflammation. PET / CT imaging can detect inflammatory activity before changes in morphology and vascular structure, and has high sensitivity, which can quickly diagnose and treat, and prevent the disease from developing to an irreversible stage.

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