

Do we need ^{18}F -FDG-positron emission tomography as a functional imaging technique for diagnosing large vessel arteritis?

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^{18}F -fluorodeoxyglucose (^{18}F -FDG) positron emission tomography (PET) has been established as a new functional imaging technique in oncology, neurology, and cardiology (1). Malignant, infectious, as well as inflammatory causes must be suspected in cases of pathologically increased ^{18}F -FDG uptake. Physiologically, ^{18}F -FDG uptake is high in the central nervous system, liver, kidneys, urinary bladder and sometimes in the myocardium. Only recently, ^{18}F -FDG-PET has been introduced as a novel and potentially useful technique for scanning and detection of metabolically active processes in large vessel diseases (Fig. 1) (2-8). With abnormal localization and intensity of ^{18}F -FDG uptake, areas of hypermetabolic activity within medium- or large-sized arteries is attributed to large vessel inflammation. We believe that the use of ^{18}F -FDG-PET should continue to be evaluated for both assessment and monitoring of treatment in cases of suspected large vessel inflammation.

Early diagnosis of large vessel arteritis, including giant cell arteritis (GCA), Takayasu arteritis, and Behçet's arteritis, is essential in order to relieve symptoms and minimize complications in affected patients. While histology is still considered the gold-standard for the diagnosis of vasculitis, histopathological confirmation of large vessel vasculitis is not always available. Biopsies of arteries are not routinely performed except in cases of suspected giant cell arteritis (GCA). In Behçet's disease, biopsies of skin, sural nerve, kidney, muscle, or testicle may show evidence of small vessel inflammation. In other clinical settings, Doppler sonography, magnetic resonance, computerized tomography-angiography, or conventional angiography can be used to support the clinical suspicion of arteritis (9). However, single positive laboratory tests or imaging studies are not

available for these idiopathic, immune-mediated large vessel arteritides.

In the future, we anticipate that ^{18}F -FDG-PET will not only be used to identify neoplastic and infectious processes, but also inflammatory diseases of the large blood vessels in patients with systemic signs and symptoms of unknown cause. The technique may also be used to detect hypermetabolic activity of large vessels when structural imaging techniques are inconclusive and to recognize vasculitic remission when vessel wall changes persist in vasculitic patients without clinical or laboratory signs of vasculitic activity. Prospective studies are needed to assess sensitivity and specificity of ^{18}F -FDG-PET studies for these purposes. As a screening tool, ^{18}F -FDG-PET has already proved superior to ^{67}Ga scintigraphy in patients with fever of unknown origin. In one study, the technique was helpful to determine the final diagnosis in 63% of these patients with fever (10). For example, ^{18}F -FDG-PETs showed increased ^{18}F -FDG uptake in the lumbar canal of a patient with tuberculous meningitis, when ^{67}Ga scintigraphy was normal. Similarly, ^{18}F -FDG-PETs were more sensitive in both GCA patients with large vessel involvement, in a case of massive inflammation of the thoracic aorta (periaortitis) and another case of transitional cell carcinoma of the urine bladder.

For each diagnostic technique, the patients' safety and comfort must be considered. Examinations using ^{18}F -FDG-PET are only minimally invasive with little discomfort, except in unusual cases of claustrophobia and pain due to a resting scan time of about 40 minutes in the supine position. All patients must fast before the application of ^{18}F -FDG, and in diabetic patients a blood glucose level of less than 110 mg% should be achieved by additional insulin adminis-

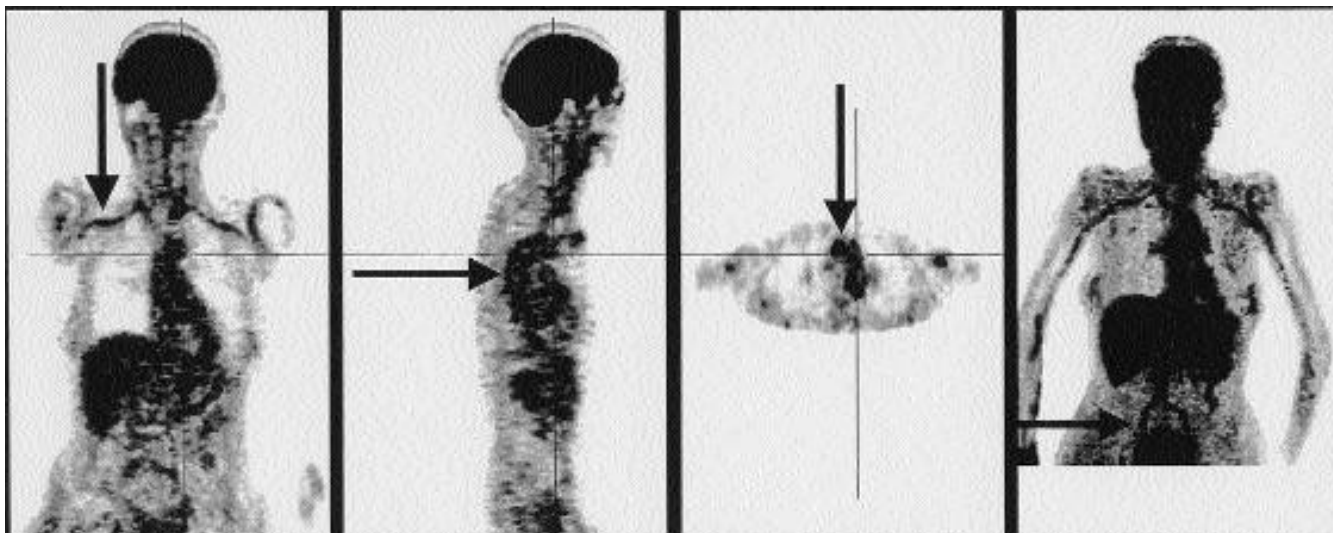


Fig. 1. ¹⁸F-FDG-PET showing increased ¹⁸F-FDG uptake along the large arteries of a 74-year-old woman with giant cell arteritis (coronal, sagittal, transaxial slices and anterior views).

tration before beginning the procedure. Thus uptake of labeled ¹⁸F-FDG will be specifically improved in metabolizing cells. Based on 10 mCi (370 MBq) injected activity, the calculated patient's absorbed radiation dose is 7mSv (=700 mrem) (11). For a mammogram, the radiation equivalent received by the breast is also between 0.05–7 mSv. Thus the radiation dose is small so that ¹⁸F-FDG is safer than other conventional radiopharmaceuticals on the market such as ⁶⁷Ga and ¹¹¹In. ¹⁸F-FDG is easy to handle and PET results can be achieved within a few hours instead of two days as compared to ⁶⁷Ga scintigraphy.

The costs of ¹⁸F-FDG-PET will come down as the number of studies performed goes up. In our institutions, the cost of a whole body ¹⁸F-FDG-PET study is comparable to that of magnetic resonance imaging with contrast enhancement. Given the diagnostic value in selected patients with suspected large vessel arteritis and systemic disease of unknown cause, the economic burden may be justified. PET scanners are now established in many medical centers for use in oncology, neurology, and cardiology. Therefore the number of commercial production sites which offer this nuclide is rapidly increasing (1). For detection of large vessel arteritis, the use of PET scanners with high sensitivity and resolution may be critical, as the target to background ratios are

often lower in inflammatory processes than in many malignant tumors.

There are still many clinical questions open, which should undergo further evaluation: Is it possible that a patient without symptoms and with normal acute phase reactants following a course of therapy will still show signs of large vessel arteritis in a ¹⁸F-FDG-PET scan? Should we perform ¹⁸F-FDG-PET only in those polymyalgic patients without adequate response to low-dose corticosteroids and with suspected GCA or underlying infectious or neoplastic disease? What are the ¹⁸F-FDG-PET findings in patients with non-GCA forms of vasculitis (e.g. polyarteritis nodosa, the ANCA-associated vasculitides, etc.)? What are the thresholds of ¹⁸F-FDG uptake to distinguish between idiopathic, immune-mediated large vessel arteritis and atherosclerosis? All of these questions will have to be addressed in the future.

At present, we think that ¹⁸F-FDG-PET is a promising new technique for both the screening of patients with systemic diseases (fever or elevated erythrocyte sedimentation rate) of unknown cause, and for functional imaging in patients with suspected large vessel arteritis. Prospective studies are warranted to further evaluate this technique in these and other clinical settings.

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