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Review

FDG-PET/CT in patients with ANCA-associated vasculitis: Case-series and literature review

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ABSTRACT

Objectives: We aimed to assess the clinical value of FDG-PET/CT in patients with ANCA-associated vasculitis.
Materials and methods: We retrospectively included 16 patients with ANCA-associated vasculitis who underwent 21 FDG-PET/CT between 2009 and 2013, in 2 university hospitals from the Paris suburb area. All FDG-PET/CTs were retrospectively analyzed and compared to clinical, biological and conventional imaging data at baseline and during the follow-up.
Results: ANCA-associated vasculitis was granulomatosis with polyangiitis (GPA, n = 10), microscopic polyangiitis (MPA, n = 4), and eosinophilic GPA (EGPA, n = 2). PET was performed at initial presentation in 14 cases and during the follow-up in 7 cases. At baseline, PET was positive in 100% of GPA patients (8/8) and in 50% (3/6) of patients with other ANCA-vasculitis ($p = 0.05$). FDG uptake tended to be higher in patients with GPA in comparison to patients with MPA/EGPA (median SUVmax: 5 versus 2.5; $p = 0.08$). Sinonasal, lung, cardio-vascular and kidney involvements were all accurately identified by PET, except in one MPA patient with glomerulonephritis. As expected, skin, joint, eye and peripheral nervous system impairments were not detected by PET. No occult site was detected by PET, except in 2 salivary gland FDG uptake without clinical abnormalities. Patients with GPA exhibited a higher number of positive sites on PET (2 [1.75–2.25] versus 0.5 [0–1], $p = 0.006$) than patients with MPA/EGPA. In pooled data including our study and the literature data of GPA patients (n=31), SUVmax was associated with Birmingham Vasculitis Activity Score (BVAS) ($r=0.49$; $p=0.03$).
Conclusion: FDG-PET/CT accurately identifies organ localizations in GPA, other than in nervous system, eye and skin, but do not bring additional benefit to the usual organ screening. The value of FDG-PET/CT in other ANCA-associated vasculitis need to be further addressed.

Contents

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1. Introduction

Anti-neutrophil cytoplasmic antibody (ANCA)-associated vasculitis is a heterogeneous group of diseases corresponding to necrotising inflammation of small vessels with a wide range of clinical presentations. ANCA-associated vasculitis includes 3 different clinical diseases which are the granulomatosis with polyangiitis (GPA), eosinophilic GPA (EGPA) and microscopic polyangiitis (MPA) [1–3].

18-F-Fluorodeoxyglucose Positron Emission Tomography with Computed Tomography (FDG-PET/CT) have been widely used in large-vessels vasculitis (Giant Cell and Takayasu arteritis) and could correlate to the disease activity [4,5]. In ANCA-associated vasculitis, particularly in GPA, acute lesions are characterized by inflammatory infiltrates which make possible the FDG uptake in this disease [6]. However, only several case-reports and one small open case-series assessed the interest of FDG-PET/CT in GPA, and data are lacking in other ANCA-associated vasculitis [7,8]. The data regarding the evaluation of disease extension in comparison to the standard screening procedure, the correlation to the disease activity and the value for each of the different ANCA-associated vasculitis is still lacking.

The aims of the present study are: (i) to describe the FDG-PET/CT findings in ANCA-associated vasculitis; (ii) to correlate FDG-PET/CT findings with clinical, biological data and disease activity; (iii) to compare patients with GPA to other ANCA-associated vasculitis (EGPA/MPA); and (iii) to assess the value of FDG-PET/CT during the follow-up. A literature review of all reported cases of ANCA-associated vasculitis with FDG-PET/CT was also performed.

2. Patients and methods

2.1. Patients

We retrospectively included 16 patients with ANCA-associated vasculitis who had undergone 21 FDG-PET/CT since 2009 in the 2 university hospitals from the Paris suburb area (Jean Verdier and Avicenne Hospitals) (two of them were previously published [8]).

All patients, except one, fulfilled ACR criteria for ANCA-associated vasculitis. One patient presented with tracheo-bronchial stenosis, without other organ involvement and negative ANCA, and was classified as GPA in the absence of other etiology after the follow-up of 2 years.

Data regarding age, gender, delay from the diagnosis of vasculitis, clinical manifestations, lung and sinonasal CT scan, echocardiography and cardiac magnetic resonance imaging (MRI), acute-phase reactants, treatments and outcome were retrospectively collected at the time of the PET and at the last visit (when available). The clinical, radiological and biological parameters were collected as previously described to determine the organ involvement: constitutional signs, kidney, ear–nose–throat (ENT), gastrointestinal, cardiovascular, skin, joint and neurological involvement (peripheral and central nervous system). The ANCA positivity was determined by indirect immunofluorescence, and if positive the presence of ANCA directed against PR3 and MPO was tested by ELISA. For the disease activity, Birmingham Vasculitis Activity Score (BVAS) and Disease Extent Index (DEI) scores were retrospectively assessed, as well as FFS revisited score [2, 9–12]. BVAS/WG was also assessed for patients with GPA.

2.2. FDG-PET/CT

All PET/CT images were acquired on a 16-slice PET/CT (Gemini TF, Philips Medical systems, The Netherlands), from the skull base to mid-thigh, 60 min after intravenous injection of 3–3.5 MBq/Kg of FDG. Acquisition duration was 1 min and 45 s min per bed position, with a total of 9–11 bed positions being used. Serum glucose level was <140 mg/dL at the time of injection in all patients. Images were acquired in 3-dimensional mode and reconstructed with and without attenuation correction (CT-based). A long fasting and low carbohydrate diet prior to PET/CT study to suppress the physiological cardiac uptake was not performed in this study. PET/CT scans were done before and <7 days after specific treatment in all cases.

A positive PET was defined as the presence of an uptake higher than background level which was not explained by the physiological uptake. The following sites were systematically analyzed by 2 senior nuclear medicine practitioners (MS and GP): lung (nodules with cavitations, infiltrates, tracheobronchial involvement, pleuresia), sinonasal mucosa, bone and cartilage, lymph nodes, submandibular and parotid glands, bone marrow, spleen, kidney, thyroid, heart, pineal gland, large vessels and paravascular areas. Pathological FDG uptake was systematically correlated to CT findings, renal ultrasound for kidney and to cardiac MRI and echocardiography for heart involvements (when available).

The maximum SUV (SUVmax) was calculated for each involved site. A SUVmax was determined for each patient as the most important SUVmax in any site of abnormal FDG uptake.

A control group with kidney chronic injury (median age: 60.5 years [51–77]; male/female ratio 6/4; creatininemia level: 301 μmol/L [211–507]) was included to determine the relation between FDG uptake and the presence and the degree of the kidney impairment.

2.3. Statistical analysis

Data are expressed as medians with interquartiles 25–75 [IQ25–75] for continuous variables and frequencies with percentages for qualitative variables. Mann–Whitney test and Fischer exact tests were used as appropriate to determine the difference between the groups. Correlation between continuous variables was tested using Pearson's coefficient correlation. Statistical analyses were carried out using GraphPad Prism version 5.1 (GraphPad Software, San Diego, 2007).

2.4. Literature review and search strategy

A bibliographic search was performed using Medline, Embase, and Web of Science (January 1990 to September 2013), by two investigators (AM and MS) using the following keywords: Wegener's disease, granulomatosis with polyangiitis, microscopic polyangiitis, Churg and Strauss disease, eosinophilic granulomatosis with polyangiitis, PET, FDG, vasculitis, systemic vasculitis, and ANCA-positive vasculitis. All articles with sufficient data were included in the literature review; if necessary, complementary data were requested from