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General review

Review article: FDG-PET in inflammatory diseases

Article de synthèse TEP-FDG et pathologies inflammatoires

S. Querellou [a,*,d], P. Robin [a,d], R. Abgral [a,d], V. Devauchelle [b,e], C. De Moreuil [c,d], P.Y. Salaun [a,d], P.Y. Le Roux [a,d], A. Le Duc-Pennec [a,d]

[a] *Service de médecine nucléaire, CHRU de Brest, 2, avenue Foch, 26609 Brest cedex, France*
[b] *Service de rhumatologie, CHRU de Brest, 2, avenue Foch, 26609 Brest cedex, France*
[c] *Service de médecine interne, CHRU de Brest, 2, avenue Foch, 26609 Brest cedex, France*
[d] *EA3878, GETBO, IFR148, université de Brest, 29200 Brest, France*
[e] *EA 2216, ESPRI 29, université de Brest, 29200 Brest, France*

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Abstract

Positron emission tomography (PET) with 18F-fluorodeoxyglucose (FDG) has for the past several years demonstrated its high value in oncology. The physiopathology of FDG explains its increasingly frequent use for inflammatory diseases such as vasculitis (giant cell arteritis or Takayasu's arteritis) as well as for granulomatous diseases (sarcoidosis, tuberculosis). The value of FDG-PET lies in its usefulness for the diagnosis of systemic diseases which includes a whole body analysis as well as a therapeutic evaluation. This review article will attempt to identify and illustrate the main features of this functional imaging.

Keywords: Vasculitis; Giant cell arteritis; Sarcoidosis; Tuberculosis; Retroperitoneal fibrosis; Inflammation; FDG-PET

Résumé

La tomographie par émission de positons (TEP) au 18-fluoro-déoxy-glucose (FDG) a démontré depuis plusieurs années tout son intérêt en cancérologie. La physiopathologie du FDG explique son application de plus en plus fréquente pour les pathologies inflammatoires telles que les vascularites (maladie de Horton ou artérite de Takayasu) ainsi que pour les granulomatoses (sarcoïdose, tuberculose). L'intérêt du TEP-FDG réside dans le diagnostic de ces maladies systémiques permettant notamment une analyse corps entier ainsi que dans l'évaluation thérapeutique. Cet article de synthèse va s'attacher à recenser et à illustrer les principales indications de cette imagerie fonctionnelle.

Mots clés : Vascularite ; Horton ; Sarcoïdose ; Tuberculose ; Fibrose rétropéritonéale ; Inflammation ; TEP-FDG

1. FDG-PET and inflammatory diseases

Positron emission tomography (PET) with 18F-fluorodeoxyglucose (FDG) has for a number of years proven its value in oncology either for initial staging, a therapeutic evaluation particularly for lymphomas or for the monitoring of tumors.

The characteristics and physiopathology of FDG explain its increasingly frequent use for inflammatory diseases such as vasculitis or sarcoidosis, in particular infectious diseases on prosthetic implant.

This review article will seek to identify the main applications for this type of imagery.

* Auteur correspondant.
E-mail address: solene.querellou@chu-brest.fr (S. Querellou).

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1.1. Vasculitis

Vasculitis designate an inflammation of the blood vessels with leukocyte infiltration responsible for different complications such as stenoses or occlusions, dissections or aneurysms.

Vasculitis differ depending on the size of the vessels concerned, affecting large, medium or small size calibers.

FDG-PET will be mainly useful for large-caliber vasculitis such as in giant cell arteritis (GCA) or Takayasu arteritis (TA) due to the few millimeters spatial resolution of PET cameras.

GCA is a granulomatous arteritis of the aorta and its main branches divide up with branches of the external carotid artery in particular the temporal arteries.

Vasculitis affects the large vascular trunk arteries, such as the aorta, subclavian arteries, carotid and the iliac arteries. It occurs most often in patients over 50 years of age with a female predominance in 2/3 of cases. The annual incidence is estimated at 100 cases per million inhabitants.

The diagnosis is crucial due to the potential risk of blindness and is confirmed by a temporal artery biopsy. However the risk of false negatives results is high, ranging from 15 to 40%. Treatment with corticosteroids is essential once the diagnosis is confirmed.

TA is a granulomatous giant cell arteritis of the aorta and central arteries (carotid, brachiocephalic trunk, subclavian arteries, and pulmonary arteries). It occurs most frequently in patients under 50 years of age with a female predominance. The countries most affected by the arteritis are Asian and South American countries as well as India. The annual incidence is estimated at 2 cases per million inhabitants. The arteritis has 2 phases, one purely inflammatory and difficult to diagnose, and the other with a lesion that occurs later with possible vascular complications. Symptoms of the pre-occlusive phase are general with fever, sweating, weight loss, arthralgia associated with skin (erythema nodosum) and ophthalmic lesions (uveitis).

The treatment of this vasculitis not only includes corticosteroids, but also immunosuppressive medication and sometimes surgery.

Morphological imaging techniques such as computed tomography (CT) or magnetic resonance imaging (MRI) or magnetic resonance angiography (MRA) and ultrasound make it easier to detect the complications of large-caliber vasculitis. According to studies published in recent years, FDG-PET seems to have a potential value in these pathologies, particularly in the early phase of the disease. In fact, it could reveal the initial inflammation of the vessels.

The study published by Treglia et al., in 2011, confirmed the value of FDG-PET in the diagnosis and assessment of large-caliber vasculitis [1]. This imaging technique seems to perform better than MRI or ultrasound to confirm the diagnosis; however it would be less useful in monitoring treatment, particularly because of the interference of corticosteroids on FDG uptake.

The meta-analysis of Besson et al., published in 2011 based on 6 articles (101 vasculitis, 182 control subjects) concluded that diagnostic performances were very interesting in this context: a sensitivity of 0.80 [95% CI: 0.63–0.91], a specificity of 0.89 [95% CI: 0.78–0.94], a positive predictive value of 0.85 [95% CI: 0.62–0.95], a negative predictive value of 0.88 [95% CI: 0.72–0.95] and a diagnostic accuracy of 0.84 [95% CI: 0.76–0.90] [2].

In 2013, Glaudemans et al. confirmed the value of the FDG-PET for the large-caliber vessels (GCA and TA) (Figs. 1–4) [3]. This imaging technique makes it possible to perform the diagnosis based on non-specific symptoms with a good diagnostic performance: for GCA, the sensitivities fluctuated between 77% and 92% and specificities between 89% and 100%; for TA, the sensitivity was estimated at 92% with a specificity of 100%. The other value highlighted in this article was the identification of the areas of increased FDG uptake as a target site from where a biopsy might best be taken, which in practice remains very complicated and rarely performed.

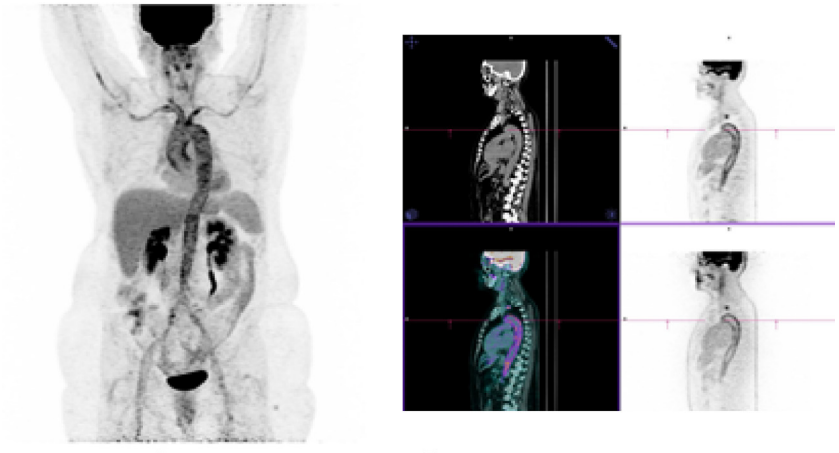

Fig. 1. A. MIP (maximum intensity projection): FDG-PET images in a 65-year-old female patient showed increase FDG uptake in the vessel wall of the aorta and supra-aortic branches suggestive of giant cell arteritis. B. Sagittal CT, PET and PET/CT slices located on the chest.
A. MIP (maximum intensity projection) : TEP-FDG chez une patiente de 65 ans retrouvant une hyperfixation intense des axes vasculaires (aorte et troncs supra-aortiques) évocatrice d'une maladie de Horton. B. Coupes sagittales de TDM, TEP et TEP/TDM centrées sur le thorax.