
The role of 18F-FDG positron emission tomography for the diagnosis of vasculitides

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ABSTRACT

Large-vessel vasculitis is the most common form of primary vasculitis comprising cranial and large-vessel giant cell arteritis, Takayasu's arteritis and idiopathic aortitis. Prompt diagnosis and treatment of large-vessel vasculitis are important to prevent potentially serious emergencies such as visual loss, vascular stenosis and aneurysm formation. Temporal artery biopsy has long been the standard for diagnosing GCA – an invasive technique that lacks sensitivity compared to a clinical diagnosis that relies on a combination of clinical symptoms, elevated serum inflammatory markers and imaging findings. Conventional angiography focussing on the detection of arterial stenoses and occlusion does not assess vessel wall changes. Therefore, angiography is being increasingly replaced by newer imaging modalities such as magnetic resonance imaging and 18F-FDG positron emission tomography-computed tomography. However, imaging modalities also including ultrasound are not uniformly used for diagnosis and monitoring of large-vessel vasculitis in clinical practice. Very recently recommendations for imaging have been developed by the European League Against Rheumatism and the Society of Nuclear Medicine and Molecular Imaging in cooperation with the European Association of Nuclear Medicine and an interest group endorsed by the American Society of Nuclear Cardiology. These and a small literature search using PubMed are the basis for this review.

Introduction

Large-vessel vasculitis (LVV) is the most common form of primary vasculitis comprising (cranial and large-vessel (LV)) giant cell arteritis (GCA), Takayasu's arteritis (TAK) and idiopathic aortitis. Prompt diagnosis and treatment of LVV are important to prevent poten-

tially serious ischaemic complications such as visual loss in GCA, vascular stenosis/occlusion in TAK and aneurysm formation in idiopathic aortitis (1, 2). An invasive surgical method, temporal artery biopsy, has long been the standard for diagnosing GCA (3-5). Although very specific, temporal artery biopsy lacks sensitivity, with many false-negative results compared to a clinical diagnosis of GCA (6), one of the reasons for this are skip lesions. Furthermore, intracranial arteries are not accessible for histological assessment, and in extracranial LV-GCA, temporal arteries are often spared (7, 8).

As a result of the above considerations, a diagnosis of GCA often relies on a combination of clinical symptoms, elevated serum inflammatory markers and imaging findings. Classification criteria for TAK are focused on detection of arterial stenoses and occlusion as detected by conventional angiography (9). This invasive imaging technique, however, is limited as it does not assess vessel wall changes. Therefore, angiography is being increasingly replaced by newer imaging modalities (10, 11) such as magnetic resonance imaging (MRI) and ¹⁸F-FDG positron emission tomography-computed tomography (PET-CT, 12-15). Aortitis is common in both, GCA and TAK. The diagnosis of idiopathic aortitis is frequently based on radiological findings with inflammatory wall changes of the aorta because histologic results can be obtained only on the basis of surgical intervention for aortic aneurysms. Imaging modalities including ultrasound (US), MRI, CT and PET in LVV although addressed in many studies, are not uniformly used for diagnosis and monitoring of LVV in clinical practice. Therefore, a European League Against Rheumatism (EULAR) project has recently been undertaken to develop recommendations for imaging in LVV (16, 17), see Table I. Furthermore, and very

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recently, recommendations of the Society of Nuclear Medicine and Molecular Imaging (SNMMI), the European Association of Nuclear Medicine (EANM), a PET-interest group endorsed by the American Society of Nuclear Cardiology (ASNC) have been published (18); an extract is presented in Table II.

The basis for this review on the use of PET-CT to detect vasculitis is a literature search using PubMed with the terms 18F-FDG positron emission tomography-computed tomography and vasculitis.

An overview of new studies published after the final date of the SLS for the EULAR recommendations

Although the uptake of ¹⁸F-FDG in the artery wall is correlated with active inflammation, some variation in that signal which may be influenced by variation in blood FDG activity due to low spatial resolution of PET. To evaluate the relationship between the maximal FDG activity in the aortic wall and mean blood activity, 37 subjects aged >55 years who were treated for hyperlipidaemia were examined with PET-CT (19). Target-to-background ratios (TBR) and arterial maximum activity minus blood activity were calculated, and multivariable regression analyses performed. Blood pool activity was positively associated with maximum artery wall standardised uptake value (SUV) as well as mean liver and spleen SUV. Artery wall activity divided by blood activity or subtraction of blood activity did not remove the statistically significant relationship to blood activity. Finally, blood pool activity was not related to TBRliver and TBRspleen (19).

Thus, in otherwise healthy individuals treated for hyperlipidaemia, blood FDG activity was associated with artery wall activity. The variation in blood activity may mask artery wall signal reflective of inflammation. This does require normalisation but blood-based TBR and subtraction did not sufficiently adjust for blood activity. The authors conclude, that more studies are needed to provide background reference tissues with cellular uptake such as liver and spleen which may better

Table I. EULAR recommendations for the use of imaging in LVV in clinical practice.

1. In patients with suspected GCA, an early imaging test is recommended to complement the clinical criteria for diagnosing GCA, assuming high expertise and prompt availability of the imaging technique. Imaging should not delay initiation of treatment.
2. In patients in whom there is a high clinical suspicion of GCA and a positive imaging test, the diagnosis of GCA may be made without an additional test (biopsy or further imaging). In patients with a low clinical probability and a negative imaging result, the diagnosis of GCA can be considered unlikely. In all other situations, additional efforts towards a diagnosis are necessary.
3. Ultrasound of temporal±axillary arteries is recommended as the first imaging modality in patients with suspected predominantly cranial GCA*. A non-compressible 'halo' sign is the ultrasound finding most suggestive of GCA.
4. High resolution MRI† of cranial arteries‡ to investigate mural inflammation may be used as an alternative for GCA diagnosis if ultrasound is not available or inconclusive.
5. CT† and PET† are not recommended for the assessment of inflammation of cranial arteries.
6. Ultrasound, PET, MRI and/or CT may be used for detection of mural inflammation and/or luminal changes in extracranial arteries to support the diagnosis of LV-GCA. Ultrasound is of limited value for assessment of aortitis.
7. In patients with suspected TAK, MRI to investigate mural inflammation and/or luminal changes should be used as the first imaging test to make a diagnosis of TAK, assuming high expertise and prompt availability of the technique.
8. PET, CT and/or ultrasound may be used as alternative imaging modalities in patients with suspected TAK. Ultrasound is of limited value for assessment of the thoracic aorta.
9. Conventional angiography is not recommended for the diagnosis of GCA or TAK as it has been superseded by the previously mentioned imaging modalities.
10. In patients with LVV (GCA or TAK) in whom a flare is suspected, imaging might be helpful to confirm or exclude it. Imaging is not routinely recommended for patients in clinical and biochemical remission.
11. In patients with LVV (GCA or TAK), MRA, CTA and/or ultrasound may be used for long-term monitoring of structural damage, particularly to detect stenosis, occlusion, dilatation and/or aneurysms. The frequency of screening as well as the imaging method applied should be decided on an individual basis.
12. Imaging examination should be done by a trained specialist using appropriate equipment, operational procedures and settings. The reliability of imaging, which has often been a concern, can be improved by specific training. Suggestions for technical and operational parameters are depicted in box 1.

Numbers in column 'LoA' indicate the mean and SD (in parentheses) of the LoA, as well as the percentage of task force members with an agreement ≥8.

*Cranial symptoms of GCA include headache, visual symptoms, jaw claudication, swelling and/or tenderness of temporal arteries.

†CT and MRI also refers to specific angiography techniques such as CT angiography (CTA) and MR angiography (MRA), and PET is commonly combined with CT or CTA.

‡Cranial arteries: superficial temporal, occipital and facial, usually all visible in one examination in MRI. EULAR, European League Against Rheumatism; GCA, giant cell arteritis; LoA, level of agreement; LoE, level of evidence; LV-GCA, large-vessel GCA; LVV, large-vessel vasculitis; PET, positron emission tomography; TAK, Takayasu arteritis.

[¹⁸F]-Fluorodeoxyglucose (FDG) positron emission tomography (PET)

- ▶▶ Hybrid PET with low-dose CT.
- ▶▶ Blood glucose levels: preferred <7 mmol/L (126 mg/dL), <10 mmol/L (180 mg/dL) acceptable.
- ▶▶ Interval between FDG infusion and image acquisition should be at least 60 min, preferably 90 min.
- ▶▶ Position of patient is supine, position of the arms should be arms down.
- ▶▶ Body parts to include: from top of head to at least mid thigh, preferably to below the knees.
- ▶▶ Scoring FDG uptake: qualitative visual grading; if result is unclear, compare it with the liver background (grading 0–3).

adjust for variation in blood activity to improve assessment of vascular activity (19).

In another study, the aim was also to explore the effect of several data acquisition and image analysis parameters on quantification of vascular wall 18F-FDG uptake measures (20). Therefore,

3 PET-CT scans were acquired 38, 60 and 90 minutes after injection of ¹⁸F-FDG in six patients with rheumatoid arthritis with high cardiovascular risk profiles. The results showed significantly higher TBRmax values at 90 vs 38 minutes. Normalising SUV for body weight, lean body mass and body sur-

Table II. FDG-PET/CT(A) imaging in large-vessel vasculitis and polymyalgia rheumatica: joint procedural recommendation of the EANM, SNMMI, and the PET Interest Group (PIG), and endorsed by the ASNC.

- Recommend patient fasting for at least 6 h prior to FDG administration, although intake of non-caloric beverages is allowed during that period
- Normal blood glucose levels are desirable, but glucose levels below 7 mmol/L (126 mg/dL) are preferable
- Withdraw or delay GC therapy until after PET, unless there is risk of ischaemic complications, as in the case of GCA with temporal artery involvement. FDG-PET within 3 days after start of GC is optional as a possible alternative
- A minimum interval of 60 min is recommended between FDG administration and acquisition for adequate biodistribution
- the use of a standardised grading system is proposed:
0 = no uptake (\leq mediastinum);
1 = low-grade uptake ($<$ liver);
2 = intermediate-grade uptake (= liver),
3 = high-grade uptake ($>$ liver), with grade 2 considered possibly positive and grade 3 positive for active LVV
- Typical FDG joint uptake patterns including scapular and pelvic girdles, interspinous regions of the cervical and lumbar vertebrae, or the knees should be evaluated and reported if present
- Normalisation of the arterial wall uptake to the background activity of venous blood pool provides a good reference for assessing vascular inflammation
- Grading of arterial inflammation against the liver background is an established method

Recommended PET interpretation criteria for clinical use

LVV visual grading (GCA and TA)

- Grade 0: No vascular uptake (\leq mediastinum)
- Grade 1: Vascular uptake $<$ liver uptake
- Grade 2: Vascular uptake = liver uptake, may be PET-positive
- Grade 3: Vascular uptake $>$ liver uptake, considered PET-positive

PMR associated visual assessment (only GCA)

- Grade 0: No uptake
- Grade 1: Uptake $<$ liver uptake
- Grade 2: Uptake = liver uptake
- Grade 3: Uptake $>$ liver uptake
- Increased metabolic activity of the scapular and pelvic girdles
- Increased metabolic activity of the knee bursae and capsule
- Increased metabolic activity at the site of the cervical and lumbar interspinous bursae
- Increased metabolic activity of the trochanteric and ischial bursae

face area had a significant influence on average SUVmax.

Intraclass correlation coefficients were high in all vascular segments when SUVmax HS was compared to SUVmax WS. SUVmax in the hot spot was consistently higher than SUVmax in the most diseased segment in all vascular segments. Blood pool activity was significantly decreased in all venous and arterial segments over time but did not differ between segments. Image matrix/voxel size did not influence SUVmax. The authors conclude that quantitative measures of vascular wall ^{18}F -FDG uptake are affected mainly by changes in data acquisition parameters. Standardisation of methodology should be considered when studying atherosclerosis and vasculitis.

The accuracy of FDG PET-CT and

contrast-enhanced CT (CECT) in evaluation of patients with large-vessel vasculitis (LVV) was compared in a retrospective study with 17 patients and 19 control subjects; mean age was 63 years, 53% were female (21). Both, the aorta:liver vascular maximum standardised uptake value (SUVmax) as assessed by PET-CT and wall thickness as assessed by CECT demonstrated a significant difference between the LVV patients and control subjects, and these parameters were significantly correlated. The area under the curve for SUVmax was 0.95 and 0.83 for mural thickening. The authors suggest that in hospitals without PET-CT or in unsuitable patients *e.g.* diabetics, CECT can be considered as a viable alternative.

In a study with 17 TAK patients, 6 were judged to be clinically active and 11

inactive (22). No significant ^{18}F -FDG accumulation was observed in the patients with inactive disease ($\text{SUV} \leq 1.2$). ^{18}F -FDG PET/CT revealed intense ^{18}F -FDG accumulation ($\text{SUV max } 2.88$) in the vasculature of 3 clinically inactive patients. The other active patients showed weak ^{18}F -FDG accumulation ($\text{SUV} \leq 1.2$). Whether the increased uptake in clinically otherwise inactive patients predicts a flare and whether a different management strategy and treatment is necessary remains currently unclear, and further studies are needed. An example of an inflamed right axillary artery is given in Fig. 1.

In a follow-up study (mean time of FU 8 months) of 37 patients (76% female, mean age 67 years) with an initially positive PET-CT for LVV, the mean TBR was decreased only slightly from 1.7 to 1.5 on FU (23). In the 21 clinically improved patients (57%), the TBR also decreased only from 1.8 to 1.5, which although statically significant from clinically non-improved patients (43%), whose TBR remained similar from 1.6 to 1.5, which does not appear clinically significant. This study leaves many open questions, including concerning the intensity of treatment. In any case, the value of PET-CT in follow-up studies of LVV appears to require further investigation.

In another longitudinal study, all 25 included patients (68% female, mean age 69 years) were either diagnosed with GCA or had a positive PET-CT and had available follow-up data for at least 12 months (mean 62 months). In only 4 cases, the repeat procedure revealed a total extinction of vascular uptake at 1 year after the first PET-CT (24). In 8 cases, a decrease in the number of vascular uptake was noted, and 10 cases revealed no changes. The 3 remaining patients' scans indicated worsening of vascular uptake in the absence of relapse. This study raises questions concerning repeated PET-CTs, as any possible role remains to be established.

Clinical performance of PET-CT in differential diagnosis with fever and/or inflammation of unknown origin

Fever of unknown origin (FUO) and inflammation of unknown origin (IUO)

are diagnostically challenging conditions. In a prospective study, the diagnostic utility of ^{18}F -FDG-PET-CT was tested in a large cohort of patients ($n=240$) with FUO or IUO (25), including 72 patients with FUO, 142 with IUO and 26 with a recent history of either one (exFUO/IUO). A final diagnosis could be established in almost 80% of patients. The leading diagnoses were adult-onset Still's disease (15%) in the FUO group, large-vessel vasculitis (21%) and polymyalgia rheumatica (18%) in the IUO group, and IgG4-related disease (15%) in the exFUO/IUO group. In 136 patients (72% of patients with a diagnosis), ^{18}F -FDG-PET-CT was positive and helpful for making a diagnosis. Predictive markers for were older age and high C-reactive protein (CRP) levels. This study strongly establishes PET-CT as a diagnostic tool in these indications (25).

A small cohort study was reported of 19 patients with ANCA-associated vasculitis (AAV), who had undergone 26 PET-CT examinations for different reasons over time (mean follow-up time 43 months (26)). The results of PET-CT outcomes compared to the final diagnoses were: 9 true positives, 3 false positives, 13 true negatives, and 1 false negative. The diagnostic sensitivity was 90%, and the specificity 81% with an accuracy of 84%. FDG-PET-CT had a high negative predictive value and ruled out the comorbidities correctly, a well-known limitation, in all but one case of urinary tract infection. This study suggests that PET-CT can be useful to rule out cancer, infection, or other diseases and comorbidities in patients with AAV.

In a retrospective case-control study in a total of 88 patients who met 1990 ACR criteria for GCA patients as reference diagnosis, the temporal, maxillary and vertebral arteries were visually rated for ^{18}F -FDG uptake by four blinded readers (27). Among 44 patients and control subjects (mean age 69 years, 57% female), 35/41 GCA patients were temporal artery biopsy positive. When all 3 arteries were included, the sensitivity was 82% and the specificity 100%, the interreader agreement was 91%. The authors concluded that conventional ^{18}F -FDG PET-CT is an accurate and re-

Fig. 1. 51yo female with GC-responsive muscle soreness and polyarthralgia since 5 months. Initially MRI, intended for myositis detection, showed vasculitis of right axillary artery (arrow in a, axial ce T1w TSE FS). Subsequent FDG-PET/CT (b, c) nicely depicted LVV of thoracic and abdominal aorta (arrowheads in b and c) as well as involvement of supraaortal branches up to the level of axillary arteries (arrows in b).

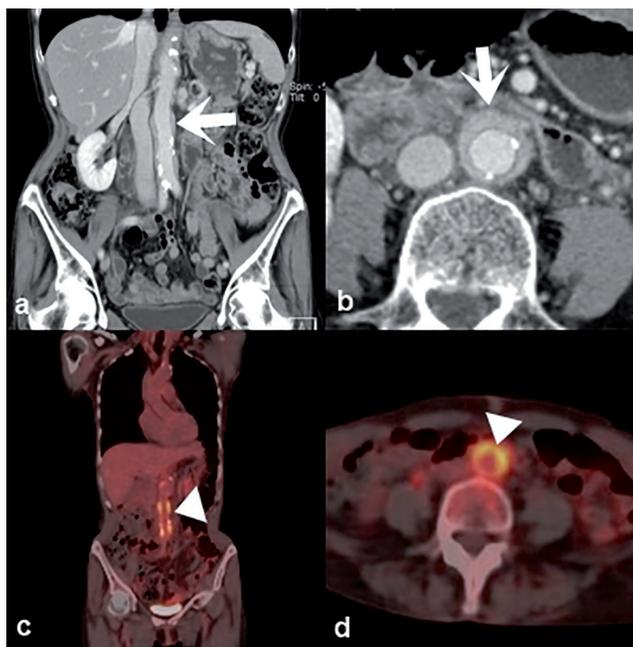
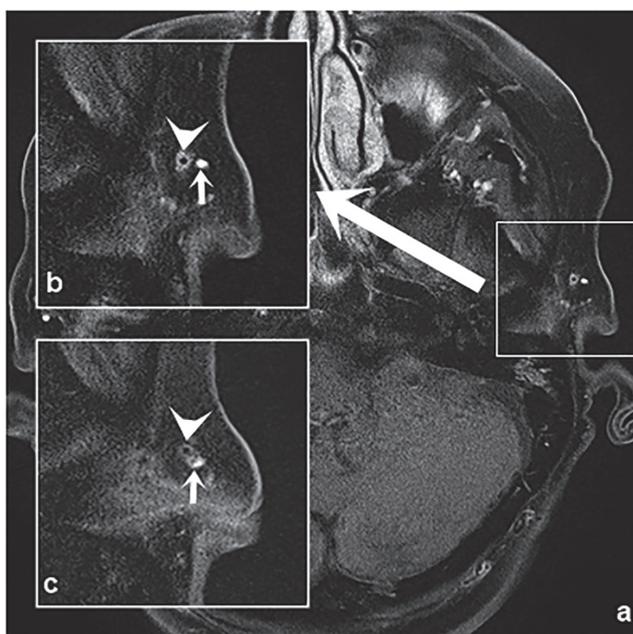


Fig. 2. 68yo female with suspected GCA and non-informative US. Contrast enhanced high resolution MRI (a), ce T1w TSE FS 1024x1024 matrix, delineates vasculitis of left A. temporalis superficialis at level of ear. The enlarged cut-out (b) shows the contrast enhancing mural thickening of the artery (arrowhead) and the concomitant vein (arrow), subsequent MRI 3 months after initiation of GC-therapy reveals subtotal regression of arterial wall thickening and enhancement (c).



liable tool to diagnose cranial arteritis in glucocorticoid-naïve GCA patients, and that ^{18}F -FDG PET-CT should always include head and neck in patients under suspicion of GCA. An example of an inflamed temporal artery is given in Fig. 2.

To compare the findings by PET-CT with CT angiography (CTA), 52 GCA patients and 27 control subjects were included in a prospective study (28). The GCA patients had a PET-CT at diagnosis (67%) or during relapse (33%). Concomitant CTA was performed in two thirds of patients. Aortitis was de-

termined as FDG uptake higher than the liver for PET and wall thickness $\geq 3\text{mm}$ for CTA. Aortitis was diagnosed using PET in 40% of patients at diagnosis, and in none of controls. Agreement was perfect between PET and CT at a patient-based level, and very good at a vascular segment-based level. PET was positive in 35% of patients during GCA relapse. Discrepancies between PET and CT were observed in only 3 cases of relapsing GCA. Correlation between the maximum standardised uptake value and wall thickness was moderate at diagnosis and not statistically signifi-

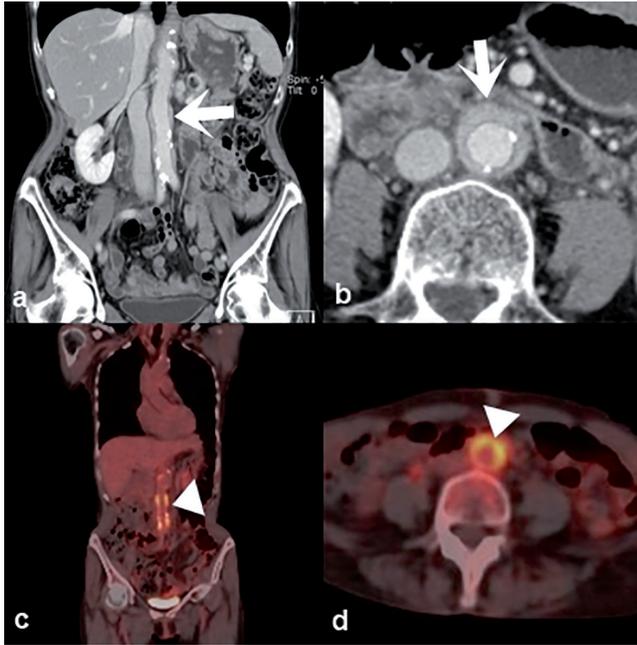


Fig. 3. 80yo female with FUI and intermittent abdominal pain. Contrast enhanced CT (a and b) for rule out of a suppurative process showed contrast enhancing circular wall thickening of abdominal aorta (arrows in a and b), subsequent FDG-PET/CT depicted increased activity concordant with LVV.

cant during relapse, potentially due to low numbers. The authors state that detection rate of aortitis in GCA patients using PET is 40%, approximately in the range of CTA, suggesting that the two techniques have similar sensitivity. PET seems slightly more valuable in relapsing GCA, but further studies concerning the specificity of this finding are needed. An example of aortic inflammation is given in Fig. 3.

The results of 3D-T1w TSE-MRI and PET/CT were retrospectively evaluated in a study on 24 patients with suspected vasculitis (29). Active vasculitis was diagnosed in 63%, while two had inactive vasculitis and 7 no vasculitis. Both methods had a high diagnostic accuracy of >80%, and were concordant in almost 80%. Among the 5 patients with discordant findings, PET-CT correctly identified 2 patients who did not have active vasculitis, and 1 of 3 who had active vasculitis, while 2 of these 3 other 3 patients were identified by MRI. These results suggest that more than one method may be needed to identify the correct diagnosis in a minority of difficult patients.

Localisation

A total of 130 consecutive ¹⁸F-FDG PET/CT scans performed during the disease course for evaluating disease activity in 15 GCA and 13 TAK patients

was examined retrospectively by two nuclear physicians blinded to clinical data (30). The aortic segments showed the highest SUV max values in both GCA and TAK, but SUV max values were significantly higher in GCA compared to TAK, except for the axillary arteries. The highest correlation in both vasculitides was seen in the ascending aorta and the aortic arch, rather than in the thoracic and or abdominal aorta.

A prospective study (31) of concordance of aortic CT angiography (CTA) and PET-CT in the detection of large-vessel involvement at diagnosis was performed in 28 patients with GCA, 75% women, median age 67, who underwent both, PET-CT and aortic CTA, before or in the first ten days following introduction of treatment. Among 19 patients with large-vessel involvement on PET-CT, 18 also had positive findings on CTA. In a per-segment analysis, a median of 5 and 3 vascular territories were involved on positive PET-CTs and CTA, respectively. In a qualitative analysis, the concordance rate between both procedures was 0.85. In a quantitative analysis, the global concordance rate was 0.64. Using FDG-PET/CT as a reference, CTA showed excellent sensitivity (95%) and specificity (100%) in a per-patient analysis. In a per-segment analysis, sensitivity and specificity were 61% and 98%, respectively. The

authors concluded that both CTA and FDG-PET/CT could detect large-vessel involvement in GCA with comparable results in a per-patient analysis. However, PET/CT showed higher performance in a per-segment analysis, especially in detection of inflammation in branches of the aorta.

A total of 30 patients with TAK underwent both, PET-CT and MRI (32). An increased FDG uptake was seen in 53% of patients and in 26% of 177 vascular lesions identified. Significant periprosthetic FDG uptake was seen in almost all 7 patients (86%) with previous vascular surgery and in almost all 11 grafts (91%). Graft-associated uptake influenced the PET results in 3 patients (10%) and the SUVmax values in 5 patients (17%). Among 39 lesions with significant tracer uptake, 15 were <4 mm thick (38%). Lesion thickness was correlated with lesion SUVmax in FDG-avid lesions only. FDG arterial uptake was not associated with systemic inflammation or NIH criteria. The authors concluded that PET-CT reveals unique and fundamental features of arterial involvement in TA. PET-CT may be useful in assessment of local inflammatory and vascular remodeling events independent of systemic inflammation during follow-up, even in lesions in which the arterial wall is <4 mm. However, the presence of arterial grafts is a potential confounder.

Influence of corticosteroid treatment

To evaluate the diagnostic accuracy of FDG PET/CT in large-vessel giant cell arteritis (LV-GCA) by serial scans before and after a short course of high-dose glucocorticoid treatment, 24 glucocorticoid-naïve patients with new-onset PET/CT verified LV-GCA (pre-treatment baseline PET) were studied prospectively. Good interrater reliability was reported (33). Although glucocorticoid treatment attenuated FDG uptake in large vessels, LV-GCA was diagnosed accurately in 10/10 patients after 3 days of treatment, but only in 5/14 patients after 10 days of treatment. Importantly, there was no correlation between CRP and FDG uptake. The observation of accurate diagnosis after 3 days of treatment is important,

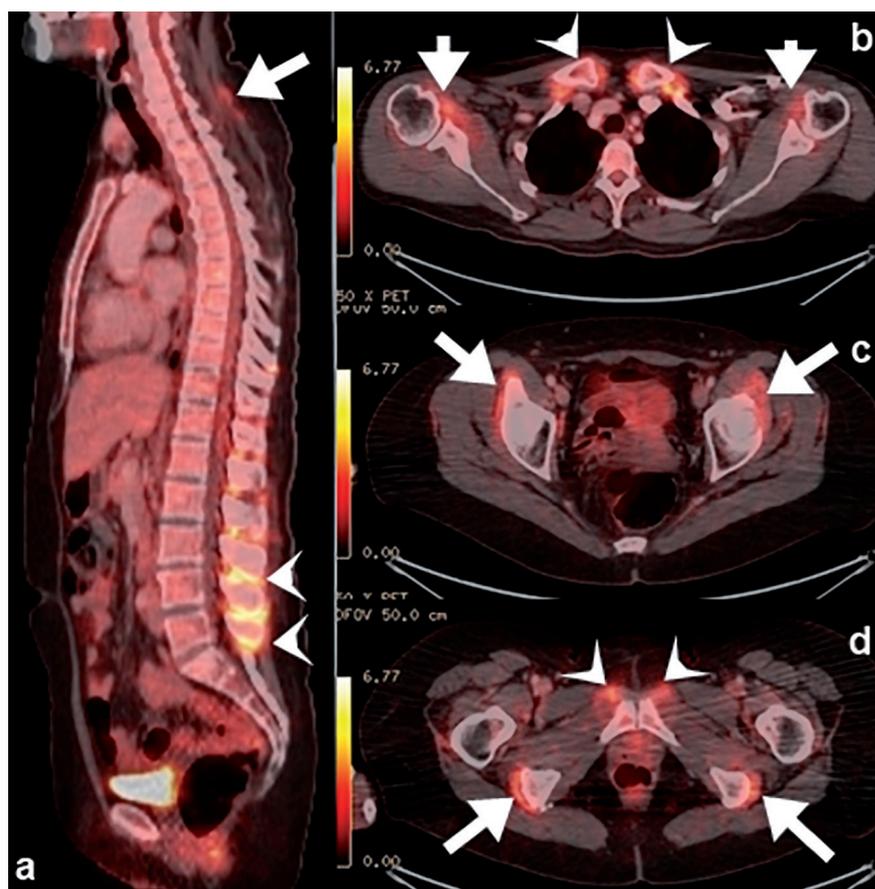


Fig. 4. 54yo female with suspected polymyalgia rheumatica, FDG-PET/CT has been intended for rule out of cancer recurrence after gynecologic malignancy. PET/CT delineates symmetric capsulitis of humeroglenoidal (arrows in **b**) and sternoclavicular joints (arrowheads in **b**), peritendinitis of straight and reflected head of *M. rectus femoris* around hip joint (arrows in **c**) as well as peritendinitis of *M. adductor longus* near symphysis (arrowheads in **d**) and hamstring at ischial tuberosity (arrows in **d**). Sagittal reformation (**a**) shows interspinous and perispinous inflammation in most caudal lumbar segments (arrowheads in **a**) and inflammation of spinal insertion of *M. trapezius* at cervicothoracic junction (arrow in **a**).

because treatment should begin immediately when the diagnosis is regarded as even possible, and sophisticated imaging may not be available at the time, but treatment should not be delayed.

In a retrospective study of 103 patients who underwent PET-CT examinations because of clinical suspicion of GCA (34), this diagnosis was confirmed in 2/3 of patients and excluded in the remainder serving as control subjects. GCA patients were older (median age 75 vs. 68 years), and they presented more often with ischaemic symptoms. The best discrimination between patients and control subjects was achieved with PET-CT findings within the supra-aortic arteries (sensitivity 70%, specificity 90%), while the specificity for the aorta and the iliofemoral arteries was lower (34%). Importantly, visual scoring was correlated poorly with SUV

measurements and had a lower diagnostic accuracy. Also, in this study, prednisone treatment for ≥ 10 days significantly reduced the sensitivity of PET-CT. In conclusion, PET-CT should be performed not later than 3 days after the initiation of glucocorticoid treatment.

Patients with new clinically diagnosed GCA who were about to start treatment with glucocorticoids underwent temporal artery biopsy and PET-CT (35). Among 28 patients with GCA, 18 had a positive biopsy+ (64%), and 28 controls were also enrolled. PET-CT scores were similar between biopsy+ and -patients with GCA. After an average of 12 days of prednisone, the scores were higher in patients with GCA compared to control subjects, for both, total uptake and in 6 of 8 specific vascular segments. The optimal cut-point to distinguish GCA cases from controls was a total PET-CT

score of ≥ 9 , with a sensitivity 71% and specificity of 64%.

Polymyalgia rheumatica

In an attempt to identify typical PET-CT findings in patients in 84 patients with classic symptoms of polymyalgia rheumatica (PMR), mean age 71 years, 61% female, a positive scan result was detected in 61%. The best set of predictors of a positive PET/CT scan were bilateral diffuse lower limb pain, pelvic girdle pain, and inflammatory low back pain (36). Similar findings have been reported by another group of investigators (37). In an original report in this supplement, these observations are largely confirmed in much detail using MRI (38). There is reason to think that MRI could become an important tool for making a diagnosis of PMR – a frequent disease for which no “gold standard” diagnostic test has been described to date. An example of the changes found in PMR is given in Fig. 4.

Conclusions

^{18}F -FDG positron emission tomography-computed tomography (PET-CT) is increasingly used technique that was shown to be useful for the detection of large-vessel vasculitis. Recent recommendations have clarified the role of PET-CT. In a large prospective study, PET-CT performed very well in patients without a definitive diagnosis who presented with fever and/or inflammation of unknown origin. Some technical and methodological problems remain to be solved, and further standardisation is needed. Comparable results are reported versus MRI and CT angiography. In certain individual patients, a combination of two techniques appears required, since discrepant information may be seen.

PET-CT detects inflammatory changes in the aorta, especially in the arch, its branches and the ascending aorta well, and also the temporal, maxillary and vertebral arteries, but performs less well in the lower extremities.

The value of follow-up examinations remains somewhat unclear, particularly interpretation of persistent inflammation on PET-CT in asymptomatic patients with normal CRP values. At present, it is unclear whether this should

have led to changes in therapeutic intervention.

Glucocorticoids have some influence on the sensitivity of PET-CT after some days, but diagnosis within the first 3 days of glucocorticoid therapy.

A PMR-specific imaging pattern may evolve. PET-CT and MRI findings confirm characteristic clinical locations and patterns of inflammation.

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