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EDITORIAL

Pulmonary artery activity in Takayasu's arteritis, a role for [18F]FDG PET/CT?

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This editorial refers to 'Value of 18F-FDG PET/CT in the evaluation of pulmonary artery activity in patients with Takayasu's arteritis' by W. Gao *et al.*, doi: 10.1093/ehjci/jeaa229.

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Takayasu arteritis (TA) is a challenging disease since disease-specific markers are lacking. A tissue biopsy is often not possible and there are no disease-specific antibodies. Also raised inflammatory markers and inflammation on imaging are not disease-specific. TA is classified using the American College of Rheumatology (ACR) 1990 criteria.[1] Assessment of the pattern and extent of inflammation and arterial involvement are essential for the optimal management and treatment of TA. There is no gold standard and one of the challenges is to differentiate activity from damage. According to the National Institute of Health (NIH) criteria active disease is defined as the presence of constitutional symptoms, new bruits, elevated acute-phase proteins, or new angiographic features.[2] In this respect, it is very important that pulmonary arteries can be visualized by positron emission tomography/computed tomography (PET/CT). Previous studies reported a wide range 0.8–50% of pulmonary artery (PA) involvement in TA. Persistent inflammation of the pulmonary arteries can result in irreversible vascular damage and life-threatening pulmonary hypertension.

Contrast-enhanced magnetic resonance imaging/magnetic resonance angiography (MRA) or CT angiography (CTA) allows non-invasive imaging of the aorta and its major branches. CTA has a high resolution with a short scanning time. It also demonstrates calcifications which are observed more frequently in atherosclerotic lesions. Three-dimensional MRA demonstrates vessel wall thickening and can also depict other signs of inflammation, including mural oedema and increased mural vascularity. Oedema and enhancement of vascular wall and an increase in wall thickness are proposed to be associated with disease activity although there is no consensus yet.

In the current issue, Gao *et al.*[3] explored the value of [18F]-fluorodeoxyglucose ([18F]FDG) PET/CT in the detection of active PA lesions in patients with TA. In total, 29 consecutive TA patients with PA involvement were prospectively recruited. Clinical activity was assessed according to the NIH criteria. CT pulmonary angiography (CTPA) or magnetic resonance pulmonary angiography (MRPA) was performed for evaluation of vascular structural characteristics, and mural thickening was considered as active TA. A vascular segment with [18F]FDG uptake ≥liver was considered as PET-active. A total of 38 [18F]-FDG PET/CT scans were performed. In terms of disease activity, the sensitivity of [18F]FDG PET/CT was not significantly different from CTPA and MRPA (71.4% vs. 92.9%, $P = 0.250$), but [18F]FDG PET/CT demonstrated a higher specificity (91.7% vs. 37.5%, $P = 0.001$) and accuracy (84.2% vs. 57.9%, $P = 0.022$). Although the majority of PET-active PA segments (54.9%) showed mural thickening, 14 PA segments with normal structure were PET-active.

In addition, [18F]FDG activity of the PA was positively correlated with inflammatory markers. Decrease in [18F]-FDG activity in PA in follow-up scans from three patients who were in remission at follow-up reflected therapeutic effects. The authors concluded that [18F]FDG PET/CT can effectively evaluate PA activity in TA patients, and its diagnostic performance is superior to CTPA and MRPA. [18F]FDG activity of PA demonstrated a clear correlation with clinical disease status and inflammatory markers and can be helpful to monitor therapeutic effects, although this was only demonstrated in three patients. These results are promising for the application of [18F]FDG PET/CT in the evaluation of PA involvement in TA. This is of particular importance in the estimation of the total disease burden and for monitoring of the effect of treatment. The current study demonstrated that [18F]FDG uptake in PA can be visualized which is important for the assessment of the overall disease activity in TA and for the evaluation of the efficacy of treatment.

Several limitations are mentioned by the authors, but some are important to solve in future studies. One concern is the subsequently

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addition of a control group of previous TA patients, including a different imaging protocol, by implementing a shorter interval between [18F]FDG administration and camera acquisition (60 min instead of 129 ± 20 min). This may have introduced, respectively, bias between patients and control group bias, and difference in vascular uptake intensity.[4] Another important technical aspect is the lack of the respiratory motion correction in the present study. Respiratory motion can definitely improve the diagnostic accuracy for detection smaller objects.[5] Particular the improvement of imaging smaller PA segmental branches is needed, to prevent missing local TA activity and total disease burden. Additionally, the introduction of digital PET significantly improved the sensitivity and resolution of the camera system.[6] Standardization of scoring of the imaging data is highly important, to prevent inhomogeneity between institutes. Recommendation is warranted and need to be followed,[7,8] but this needs to be updated to include other vascular branches that are involved in TA, such as the pulmonary, renal, mesenteric arteries, and the coeliac trunk.

[18F]FDG PET/CT can locate inflammation in TA and provide visual information for monitoring therapeutic effectiveness. Both, morphology and biological vascular wall properties are necessary to monitor, development of aneurysm(s), aorta dilation and stenosis (in case of pulmonary arteries causing pulmonary hypertension) and recurrence of vascular wall inflammation, and the interrelation between them. We should therefore emphasize the unique utility of applying [18F]FDG PET/CT in the early stage of TA, particularly because it allows early detection and early start of treatment that may help to reverse the development of damage, including the pulmonary branches.

Disclosures

Dr. E. Brouwer as an employee of the UMCG received speaker fees and consulting fees from Roche in 2017, 2018 which were paid to the UMCG.

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