How useful is 18F-FDG PET/CT in patients with suspected vascular graft infection?

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Received Jul 4, 2018; accepted Jul 5, 2018
doi:10.1007/s12350-018-1377-6

See related article, pp. 294–302

In recent years, 18F-fluorodeoxyglucose positron emission tomography / computed tomography (18F-FDG PET/CT) has been increasingly used for the diagnosis of cardiovascular infections, including infective endocarditis, prosthetic valve endocarditis (PVE), and to some extent cardiovascular implantable electronic device (CIED) infection.^{1–3} Similar to the aforementioned infections, prosthetic vascular graft infection (PVGI), whose incidence is estimated to vary from 1 to 6 percent, carries a significant risk of morbidity and mortality.^{4,5} An early definite diagnosis is therefore crucial, and adequate management depends among other things on accurate diagnosis and proper delineation of the extent of infection.⁵ In this regard, 18F-FDG PET/CT is now proposed as a valuable imaging procedure owing to its very high sensitivity and negative predictive value (NPV), albeit with relatively low specificity and high false-positive rate in PVGI, because increased 18F-FDG activity may also occur in the absence of an acute infectious process.^{6,7} In order to improve the specificity and accuracy, recent studies have evaluated grading systems, visual scores and semi-quantitative measurements, as well as taking uptake patterns into account.^{6,8,9} Observations have also hinted that the overall diagnostic accuracy of 18F-FDG PET/CT is affected by clinical

variables such as the elapsed time since the initial surgery, prior administration of antibiotics and duration thereof, presence of active large vessel vasculitis, and the type of graft material used, among others.^{7,9,10}

In this issue of the Journal, Bowles et al report on the use of 18F-FDG PET/CT in 49 patients with suspected PVGI.¹¹ In their prospective study, they obtained a sensitivity of 88% (NPV 93%) and a specificity of 79% (positive predictive value (PPV) 67%). Sixteen out of 49 subjects (33%) were truly infected. They were able to demonstrate that most cases of infection presented a focal pattern, as opposed to a diffuse (homogeneous) pattern predominantly seen in patients without infection. They also showed that in 5 out of 7 (71%) of their false-positive cases, a patched (inhomogeneous) pattern was present with areas of highest uptake corresponding to the application of surgical adhesives. This represents a new, interesting and relevant finding. In part for this reason, the use of surgical adhesives should be clearly described in operative protocols, especially the type of material used and the area where it was applied. In this particular study, the exclusion of such adhesive-matched positive uptakes increased the specificity and PPV to 93% and 87%, respectively. As reported by previous authors, Bowles et al did not find additional value of semi-quantitative indices such as SUVmax or M-TBR to better discriminate between inflammation and infection.¹² However, as also previously reported with CIED infection and PVE, 18F-FDG PET/CT in this study was able to correctly identify extra-prosthetic infections such as infected hematomas.

For consistent image interpretation, it will be important to develop a precise and standard definition for each uptake pattern. In the article by Bowles et al, the uptake-pattern agreement between two experienced nuclear medicine physicians was only 78%. This discrepancy could be even more important in other centers.

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J Nucl Cardiol 2020;304–5.

1071-3581/\$34.00

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It is important to remember that the pattern of uptake is key since less than one-third of the patients without infection had no uptake. As opposed to patients with CIED implanted for several months, most patients with vascular grafts showed 18F-FDG uptake despite the absence of graft infection.^{9,13} Keidar et al demonstrated a diffuse 18F-FDG uptake in 92% of non-infected vascular prostheses.⁹ In this study, a homogeneous pattern was more prevalent in Gore-Tex grafts, whereas an inhomogeneous uptake was seen more in Dacron vascular grafts. Furthermore, surgical adhesives such as “BioGlue” can lead to significantly increased or inhomogeneous uptake. 18F-FDG PET/CT interpretation in these cases will require knowledge of the actual surgical protocols. However, it is important to keep in mind that the use of surgical adhesives does not per se rule out the possibility of infection when a patched uptake is observed. In the present study by Bowles et al, it would have been interesting to complete the evaluation of these patients with a radio-labelled leukocyte scan. Recent technological advances such as SPECT/CT have greatly improved the accuracy of leucocyte scintigraphy¹⁴ and this exam should be used more often either as a stand-alone or as an adjunct to 18F-FDG PET/CT in equivocal cases. The number of patients in this study is relatively small, and validation of these results in a larger study would be of benefits. It should also be kept in mind that prolonged antibiotic administration prior to 18F-FDG PET/CT imaging, as it is often the case in clinical settings, was prevalent in this study. Ideally, 18F-FDG PET/CT should be performed earlier in the evaluation process when a PVGI is suspected. These issues need to be addressed in future prospective randomized larger series.

In conclusion, the study by Bowles et al provides new information and confirms the benefit of 18F-FDG PET/CT in the evaluation, diagnosis, and management of cardiovascular infections, including PVGI. 18F-FDG PET/CT is also useful to better delineate soft tissue infection adjacent to the vascular graft and identify extra-prosthetic sites of infection. Knowledge of the expected 18F-FDG uptake pattern in different non-infected grafts types and localization of surgical adhesives such as “BioGlue” is mandatory to improve the diagnostic accuracy and decrease the false-positive rate.

Disclosure

The authors have nothing to declare. The authors declare that no potential conflict of interest exists and that all of them have read and approved the manuscript.

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