Challenging but Clinically Useful

Fluorodeoxyglucose PET/Computed Tomography in Inflammatory and Infectious Diseases

Gormsen, Lars Christian; Hess, Søren

Published in:
PET Clinics

DOI:
10.1016/j.cpet.2020.01.002

Publication date:
2020

Document version:
Accepted manuscript

Citation for pulished version (APA):
Gormsen, L. C., & Hess, S. (2020). Challenging but Clinically Useful: Fluorodeoxyglucose PET/Computed Tomography in Inflammatory and Infectious Diseases. *PET Clinics*, *15*(2), xi-xii. https://doi.org/10.1016/j.cpet.2020.01.002

CLINICS PREFACE TEMPLATE

TITLE

Challenging but clinically useful: FDG PET/CT in inflammatory and infectious diseases.

BODY OF PREFACE

Contemporary FDG PET/CT is a valued and integrated part of staging and treatment monitoring of malignant diseases, a development permitted by decades' long massive investment in PET/CT systems by tertiary medical centers worldwide. It was recognized early in the history of PET/CT that as a glucose analogue, FDG was taken up by inflammatory cells as well as by malignant tissue, but initially this non-specific property of the tracer was considered a nuisance since it caused false positive findings in the oncologic population (1). Despite early positive reports of FDG-PET imaging used to diagnose bacterial abscesses (2), promising autoradiography studies demonstrating FDG uptake in neutrophile leukocytes, and evidence of increased glucose transporter activity during inflammation (3, 4), FDG was not widely explored clinically – the nuclear medicine armamentarium already included several much more widely available and allegedly more specific gamma camera based infection and inflammation tracers. Nevertheless, in parallel with the increasing demand for oncology FDG PET/CT scans, excess scanner capacity has gradually allowed for a broader exploration and clinical use of FDG-PET/CT in a range of inflammatory and infectious diseases such as large vessel vasculitis (LVV), polymyalgia rheumatica (PMR), sarcoidosis, prosthesis infections and more heterogeneous entities like fever of unknown origin (FUO).

However, correct acquisition and interpretation of non-oncology FDG PET/CT is associated with several challenges. First, even though a joint EANMMI/SNMMI procedure guideline on FDG-PET/CT for infectious and inflammation is available (5), optimal scan parameters are still largely unexplored; they are usually extrapolated from the oncologic setting, but the distribution of some infectious or inflammatory diseases may require more focused imaging on specific areas, e.g. extremities or cranial arteries. Second, some populations are very heterogeneous and consequently scan indications may be just as wide; this is especially evident in FUO with very diverse patient characteristics, definitions, baseline tests and image interpretation, which renders direct comparison and pooling of data exceedingly difficult. Third, non-oncology FDG PET/CT scans are rarely performed at first presentation of disease; it may in fact be the clinician's last diagnostic resort. As a result, FDG PET/CT images of e.g. inflammatory diseases reflect widely differing stages of disease and images consequently may differ substantially visually. Fourth, since non-oncology FDG PET/CT is typically used as an adjunct imaging technique, patients have often been treated by either corticosteroids or antibiotics prior to referral, which may result in suppression of FDG uptake by inflammatory cells. Fifth, pathological FDG uptake indicating a specific inflammatory or infectious disease is rarely confirmed by biopsy but rather by clinical outcome.

As a result of these particular challenges, it has been difficult to establish robust threshold values for what constitutes pathological FDG uptake and also to agree on particular patterns of FDG distribution specific for each inflammatory or infectious disease.

In this issue of PET Clinics, we aim to address these problems and present the most up-to-date knowledge of when and how to use FDG PET/CT in inflammatory and

infectious diseases. We have included an initial paper detailing correct patient preparation and the caveats associated with concurrent treatment with metformin and corticosteroids (Hess 1). Optimal use of FDG PET/CT to diagnose the inflammatory diseases LVV (Nielsen), PMR (Betrains), inflammatory bowel disease (Brodersen) and sarcoidosis (Basu) is discussed in separate papers. Infectious diseases are discussed in papers concerning FUO, bacteremia and febrile neutropenia (Hess 2), the infected heart (Scholtens), and bone related infections (Kwee). Finally, three papers discuss more experimental approaches to non-oncology PET/CT (low-grade inflammation (Reddy), inflammation beyond FDG (Lapa) and quantification in tuberculosis (Deogaonkar)).

As cliché and generic as it may sound, it is imperative that we raise the scientific bar within the overall clinical entity of FDG-PET/CT imaging of infectious and inflammatory diseases. In particular, future efforts should focus on generating valid and robust data from well-designed prospective studies on well-established indications with well-prepared and relevant patient populations.

1. Larson SM. Cancer or inflammation? A Holy Grail for nuclear medicine. Journal of nuclear medicine : official publication, Society of Nuclear Medicine. 1994;35(10):1653-5.
2. Tahara T, Ichiya Y, Kuwabara Y, Otsuka M, Miyake Y, Gunasekera R, et al. High [18F]-fluorodeoxyglucose uptake in abdominal abscesses: a PET study. Journal of computer assisted tomography. 1989;13(5):829-31.
3. Yamada S, Kubota K, Kubota R, Ido T, Tamahashi N. High accumulation of fluorine-18-fluorodeoxyglucose in turpentine-induced inflammatory tissue. Journal of nuclear medicine : official publication, Society of Nuclear Medicine. 1995;36(7):1301-6.
4. Sugawara Y, Gutowski TD, Fisher SJ, Brown RS, Wahl RL. Uptake of positron emission tomography tracers in experimental bacterial infections: a comparative biodistribution study of radiolabeled FDG, thymidine, L-methionine, 67Ga-citrate, and 125I-HSA. European journal of nuclear medicine. 1999;26(4):333-41.

5. Jamar F, Buscombe J, Chiti A, Christian PE, Delbeke D, Donohoe KJ, et al. EANM/SNMMI guideline for 18F-FDG use in inflammation and infection. Journal of nuclear medicine : official publication, Society of Nuclear Medicine. 2013;54(4):647-58.

GUEST EDITOR'S NAME (OR EDITORS' NAMES)

[1,2]Lars Christian Gormsen, MD, PhD, senior chief physician, associate professor, head of research

[3,4]Søren Hess, MD, senior chief physician, head of section, associate professor, head of research

AFFILIATIONS

[1]Department of Nuclear Medicine & PET Centre, Aarhus University Hospital, 8200 Aarhus N, Denmark

[2]Department of Clinical Medicine, Aarhus University, Aarhus, Denmark

[3]Department of Radiology and Nuclear Medicine, Hospital of Southwest Jutland, 6700 Esbjerg, Denmark

[4]Department of Regional Health Research, Faculty of Health Sciences, University of Southern Denmark, Odense, Denmark

CONTACT INFORMATION

Lars Christian Gormsen, Dept. of Nuclear Medicine & PET Centre, Aarhus University Hospital, Palle Juul-Jensens Boulevard 165, 8200 Aarhus N; larsgorm@rm.dk

Søren Hess, Dept. of Radiology and Nuclear Medicine, Hospital of Southwest Jutland, Finsensgade 35, 6700 Esbjerg, Denmark; soren.hess@rsyd.dk

GUEST EDITOR'S PHOTO (OR EDITORS' PHOTOS)

Attach a photo of each Guest Editor for the issue