Contribution of [18F] FDG PET/CT in the Diagnosis of Prosthetic Valve Infective Endocarditis: A Case Report

Zakaria Ouassafrar[ORCID1*], Abdel Amide Gbadamassi[ORCID1], Halima Batani[ORCID1], Hafsa Bensimimoun[1], Amal Guensi[ORCID1]

[1]Nuclear Medicine Department, Ibn Rochd University Hospital Center, Casablanca, Morocco

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Abstract

Introduction: *Infective endocarditis is a potentially life-threatening disease that requires rapid and accurate diagnosis. Recently, [18F] FDG PET/CT has been incorporated as a new major criterion for the diagnosis of infective endocarditis.*

Case report: *This report describes a 54-year-old female patient who underwent mitral valve replacement in 2018 for symptomatic severe mitral stenosis with atrial fibrillation. She presented with infectious symptoms on clinical examination. Following transthoracic and transesophageal echocardiography, the differential diagnosis included prosthetic valve infective endocarditis versus mechanical prosthesis thrombosis. [18F] FDG PET/CT ultimately confirmed the diagnosis of prosthetic valve infective endocarditis.*

Conclusion: *This case highlights the significant advantages of [18F] FDG PET/CT in the diagnostic evaluation of patients with suspected prosthetic valve infective endocarditis, particularly when conventional echocardiographic examinations are inconclusive.*

Keywords: *Endocarditis, Fluorodeoxyglucose F18, Positron Emission Tomography*

[*]Corresponding author: Zakaria Ouassafrar - received: 27.09.2025 - peer reviewed, accepted and published: 31.10.2025

Introduction

Infective endocarditis is an infection of the endocardium, heart valves, or implanted cardiac devices (1). It is a relatively rare condition, with a prevalence ranging from 1.5 to 11.6 cases per 100,000 person-years (2). Its incidence has increased, affecting 3 to 10 people per 100,000 inhabitants per year in developed countries (3, 4).

Despite advances in diagnosis and therapy, it is associated with a poor prognosis, with a mortality rate of up to 25%. Approximately 32.5% of these patients have a prosthetic heart valve, which represents a predisposing factor for infection and places these patients in a specific population group with a different epidemiological profile (5).

In recent years, significant progress has been made in the use of imaging techniques as complementary methods to facilitate the diagnosis of infective endocarditis. The 2023 update of the Duke criteria, endorsed by the European Society of Cardiology, has incorporated 18-fluorodeoxyglucose positron emission tomography/computed tomography ([18F] FDG PET/CT) as a new major criterion for the diagnosis of infective endocarditis (6). This imaging technique relies on the increased glycolytic activity of inflammatory cells following pathogen invasion (7, 8).

Despite growing evidence demonstrating its utility, its use remains limited and, until now, it has not been fully integrated into the diagnostic strategy of scientific societies (5).

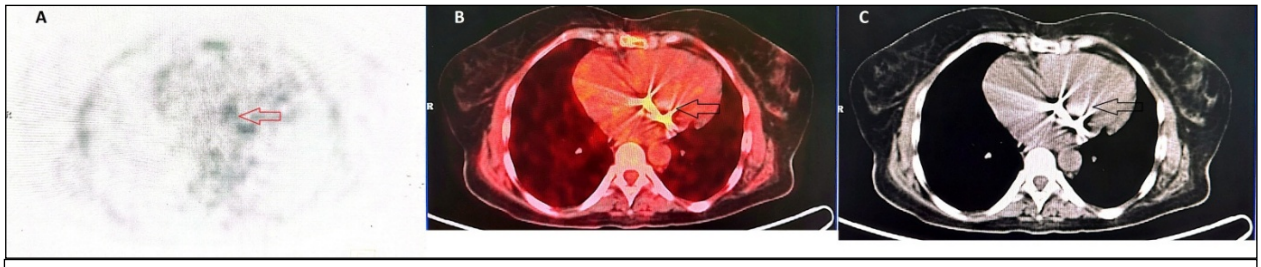

Figure 1: *Intense focal FDG uptake at the prosthetic and periprosthetic regions with a SUVmax of 2.6;* ***A:*** *PET image;* ***B:*** *PET/CT fusion image;* ***C:*** *CT image*

In this study, we aim to highlight the contribution of [18F] FDG PET/CT in the diagnosis of infective endocarditis on prosthetic heart valves.

Case Report

This case concerns a 54-year-old female patient with an 18-year history of diabetes managed with insulin therapy and a seven-year history of hypertension treated with losartan and bisoprolol. She underwent mitral valve replacement in 2018 due to symptomatic severe mitral stenosis associated with atrial fibrillation.

On clinical examination, the patient was febrile and tachycardic, with a heart rate of 125 beats per minute and a fasting capillary blood glucose of 1.72 g/L. Cardiac auscultation revealed a prosthetic click audible at the mitral area. The electrocardiogram showed a heart rate of 112 beats per minute, narrow QRS complexes, and monomorphic left ventricular premature contractions. Laboratory tests revealed leukocytosis with neutrophilia (11,181 leukocytes/µL, 9,440 neutrophils/µL) and a C-reactive protein level of 253 mg/L. Four pairs of blood cultures were positive for Escherichia coli.

Transthoracic echocardiography revealed a reduced jet at the level of the mitral prosthesis, resulting in obstruction with antegrade flow. Transesophageal echocardiography showed a mobile, homogeneous, echogenic structure with a vibratile appearance on the anterior atrial side measuring 10×10 mm. The differential diagnosis included prosthetic valve infective endocarditis versus mechanical prosthesis thrombosis.

An [18F] FDG PET/CT was requested to confirm the diagnosis of infective endocarditis on the mitral prosthetic valve.

Examination Protocol

The fasting capillary blood glucose was 6.4 mmol/L after six hours of fasting. Sixty minutes following intravenous injection of 204 MBq of [18F] FDG, images were acquired using a PET/CT scanner (Siemens Biograph 6, TruePoint PET CT) from the skull to mid-thigh. The protocol included an initial helical CT acquisition with 6 slices (acquisition parameters: 110 kVp tube voltage, 95 mA, pitch 1.75:1, slice thickness 5 mm, and rotation time 1.5 s per rotation).

PET images from the cranial vault to mid-thigh were acquired in 3D mode without breath-holding, with an acquisition time of 3 minutes per bed position (total of 7 bed positions), each covering 15 cm, with an axial sampling thickness of 3 mm per slice. PET/CT images were reconstructed using iterative attenuation-corrected reconstruction derived from the CT images with subset maximization software (8 subsets, 4 iterations).

Imaging results (Fig.1)

The study revealed intense focal FDG uptake at the prosthetic and periprosthetic regions in the thoracic area, with a SUVmax of 2.6. Mild circumferential hypermetabolism was observed at the right atrium, with a SUVmax of 1.4. The diagnosis of prosthetic valve infective endocarditis was confirmed.

Discussion

Infective endocarditis is a potentially life-threatening disease that requires rapid and accurate diagnosis. In patients with prosthetic heart valves, infection typically involves the suture line and annulus, leading to perivalvular abscesses, dehiscence, pseudoaneurysms, and fistulas (9). Both underdiagnosis and overdiagnosis of infective endocarditis can result in a significant risk of death, considerable morbidity, unnecessary antibiotic therapy, and excessive costs (9). Although transthoracic and transesophageal echocardiography have relatively high specificity for diagnosis, their sensitivity ranges

from 40% to 80%. Small perivalvular abscesses, in particular, are more difficult to detect using these echocardiographic techniques (9).

[18F] FDG PET/CT combines a highly sensitive technique for detecting infection-related inflammatory activity (PET) with high-resolution anatomical imaging (CT) to evaluate structural lesions associated with endocarditis (9). The diagnostic sensitivity of [18F] FDG PET/CT is close to 100% (10). The European Society of Cardiology supports the use of [18F] FDG PET/CT in the diagnostic workup of infective endocarditis (11). Moreover, the 2023 update of the Duke criteria incorporated [18F] FDG PET/CT findings as a major diagnostic criterion for infective endocarditis (6). This study demonstrated the benefit of [18F] FDG PET/CT in the diagnosis of infective endocarditis. [18F] FDG is a glucose analogue used to identify sites of infection and vascular inflammation by highlighting cells with increased metabolic activity, such as activated leukocytes, monocytes, macrophages, and CD4+ T-lymphocytes (9).

Some authors (12, 13) have proposed radiolabeled leukocyte scintigraphy as an alternative diagnostic technique in this context. Unfortunately, this approach is time-consuming and requires handling of blood samples. Although it may be somewhat more specific than [18F] FDG PET/CT, its sensitivity is significantly lower (14). Several studies have confirmed that [18F] FDG PET/CT can also detect septic emboli in patients with endocarditis (8). For this reason, it has been suggested that [18F] FDG PET/CT should be included in the diagnostic workup of all confirmed cases of prosthetic endocarditis to identify potential extracardiac infectious emboli (15).

Conclusion

This case confirms the considerable advantages of [18F] FDG PET/CT in the diagnostic evaluation of patients with suspected infective endocarditis on prosthetic valves, particularly when echocardiographic examinations are inconclusive. These findings may have a significant impact on patient morbidity and mortality related to infective endocarditis. The benefits of [18F] FDG PET/CT are primarily associated with the early identification of endocardial involvement and improved assessment of perivalvular lesions.

Correspondence to:
Zakaria Ouassafrar

Nuclear Medicine Department, Ibn Rochd University Hospital Center, Casablanca, Morocco

Declarations

Consent for publication: The authors clarify that written informed consent was obtained and the anonymity of the patient was ensured. This study submitted to Swiss J. Rad. Nucl. Med. has been conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards.

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1. Zakaria Ouassafrar: Conceptualization, investigation, data curation, writing – original draft.
2. Abdel Amide Gbadamassi: Methodology, supervision, writing – review & editing.
3. Halima Batani: Formal analysis, visualization.
4. Hafsa Bensimimou: Formal analysis, visualization.
5. Amal Guensi: Supervision, project administration, validation

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