

¹⁸F-FDG-PET/CT optimizes treatment in *Staphylococcus aureus* bacteremia and is associated with reduced mortality

Marvin A.H. Berrevoets¹, Ilse J.E. Kouijzer¹, Erik H.J.G. Aarntzen¹, Marcel J.R. Janssen¹, Lioe-Fee De Geus-Oei^{2,3}, Heiman F.L. Wertheim¹, Bart-Jan Kullberg¹, Jaap Ten Oever¹, Wim J.G. Oyen^{1,4}, Chantal P. Bleeker-Rovers¹

¹Radboud university medical center, departments of Infectious Diseases, Nuclear Medicine and Microbiology, ²Leiden university medical center, ³MIRA Institute for Biomedical Technology and Technical Medicine, Biomedical Photonic Imaging Group, University of Twente. The Netherlands, ⁴Institute of Cancer Research and Royal Marsden NHS Foundation Trust, London

Introduction

Metastatic infection is an important complication of *Staphylococcus aureus* bacteremia (SAB). Early diagnosis of metastatic infection is crucial, as specific treatment is required. However, metastatic infection is often asymptomatic and difficult to detect.

Purpose of the study: to investigate the role of ¹⁸F-FDG-PET/CT in patients with high-risk SAB for detection of metastatic infection and its consequences for treatment and outcome.

Methods

All patients with high-risk SAB at Radboud university medical center between January 2013 and April 2016 were retrospectively included. Clinical data and results of ¹⁸F-FDG-PET/CT and other imaging techniques, including echocardiography, were collected. High-risk SAB was defined as at least one of the following risk factors: community-acquisition, treatment delay >48 hours, fever >72 hours after treatment initiation, persistent positive blood cultures >48 hours after treatment initiation, or confirmed metastatic infection at presentation.

Primary outcome: newly diagnosed metastatic infection by ¹⁸F-FDG-PET/CT, subsequent treatment modifications, and outcome.

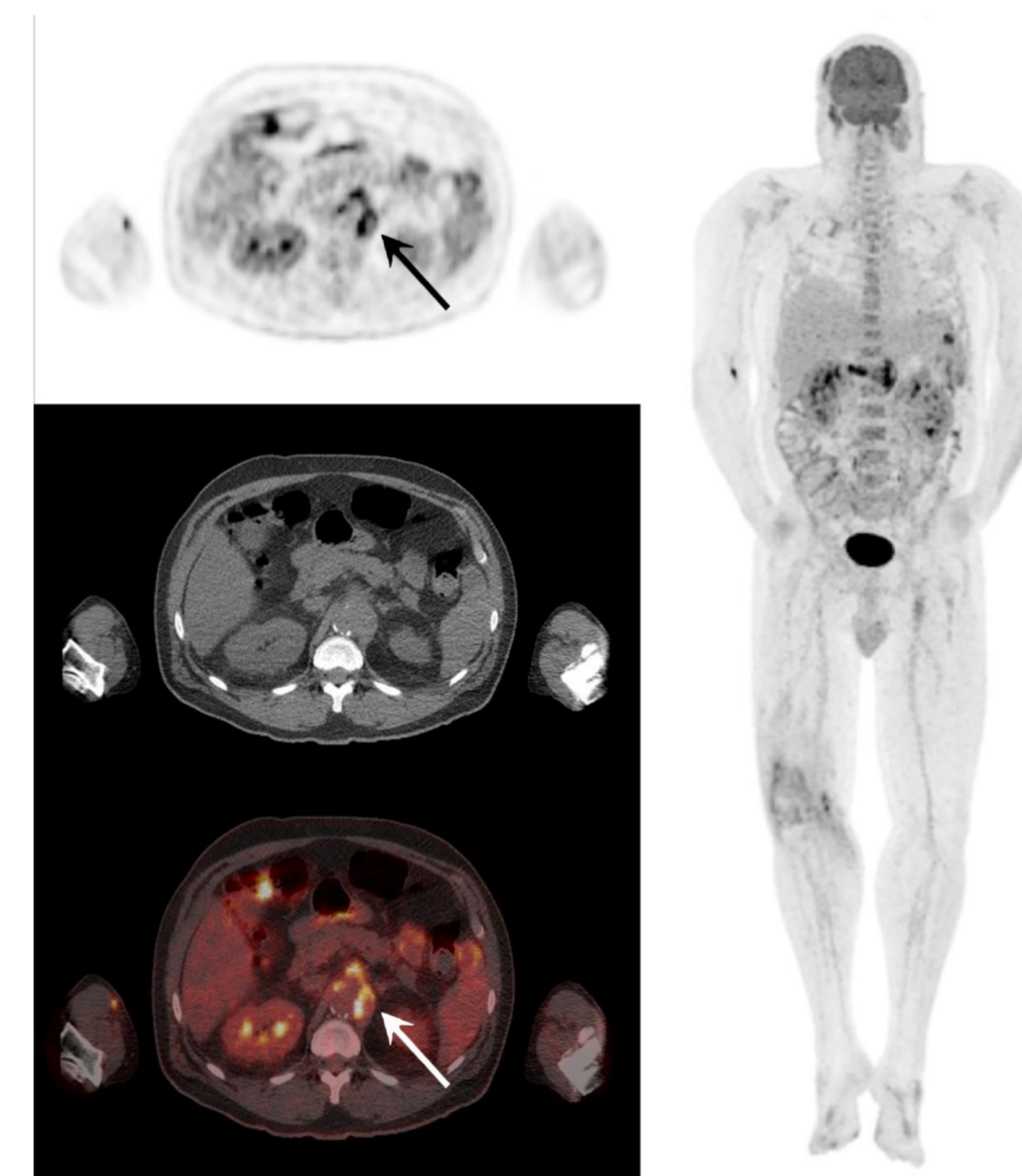
	Alive at 3 months (n=120)	Dead at 3 months (n=28)	OR (95% CI) in multivariate analysis
Composite risk score* (SD)	1.65 (1.14)	1.93 (1.09)	1.537 (0.997-2.371)
Charlson comorbidity score (SD)	4.24 (2.90)	6.46 (3.49)	1.254 (1.078-1.457)
¹⁸ F-FDG-PET/CT performed	87 (72.5)	12 (42.9)	0.204 (0.066-0.624)
ID specialist consultation	99 (82.5)	20 (71.4)	0.851 (0.266-2.721)
ICU admission	29 (24.2)	11 (39.3)	2.147 (0.809-5.698)

* Composite risk score: community-acquisition, persistent fever >72 hours, and skin findings suggesting the presence of metastatic infection were separately scored as 1 point, and positive follow-up blood culture results were scored as 2 points.

Results

148 patients with high-risk SAB were included and 99 ¹⁸F-FDG-PET/CT scans were performed.

- ¹⁸F-FDG-PET/CT detected metastatic infectious foci in 73.7% of patients with high-risk SAB.
- In 71.2% of patients, no signs of metastatic foci were present before ¹⁸F-FDG-PET/CT was performed.



Treatment modification (n=99)	n (%)
Extension of treatment	
Prolonged intravenous antibiotic therapy	15 (15.2)
Addition of a second antimicrobial drug	10 (10.1)
Extension of treatment duration	35 (35.3)
Surgical or radiological intervention	19 (19.2)
Shortening of treatment duration	25 (25.3)
No treatment modification	25 (25.3)

¹⁸F-FDG-PET/CT images of a 60-year-old man who was admitted because of SAB. Besides an arthritis of his right knee ¹⁸F-FDG-PET/CT also showed a mycotic aneurysm of the celiac trunk (arrows) and multiple small abscesses in liver and spleen. This patient underwent a surgical repair of the celiac trunk and intravenous antibiotic therapy was given for an extended period.

Conclusions

- ¹⁸F-FDG-PET/CT is significantly associated with reduced mortality in patients with high-risk SAB.
- ¹⁸F-FDG-PET/CT leads to the detection of metastatic infectious foci in 73.7% of patients, resulting in important treatment modifications in 74.8% of all patients
- ¹⁸F-FDG-PET/CT should be recommended as standard imaging technique for all patients with ≥1 risk factor for metastatic infection in SAB guidelines.