

살모넬라 감염성 복부 대동맥류 환자에서 F-18 FDG PET/CT의 역할

인하대학교 의과대학 핵의학교실¹, 내과학교실², 방사선과학교실³
최승진¹ · 이진수² · 정문현² · 변성수³ · 현인영¹

Role of F-18 FDG PET/CT in the Management of Infected Abdominal Aortic Aneurysm due to Salmonella

Seung Jin Choi, M.D.¹, Jin Soo Lee, M.D.², Moon Hyun Cheong, M.D.²,
Sung Su Byun, M.D.³, and In Young Hyun, M.D.¹

Departments of ¹Nuclear Medicine, ²Internal Medicine, and ³Radiology, Inha University College of Medicine, Incheon, Korea

We present a case of infected abdominal aortic aneurysm due to salmonella enteritidis. F-18 FDG PET/CT was performed to diagnosis and during follow-up after antibiotic treatment. Computed tomography (CT) is considered to be the best diagnostic imaging modality in infected aortic lesions. In this case, a combination of CT and FDG PET/CT provided accurate information for the diagnosis of infected abdominal aortic aneurysm. Moreover, FDG PET/CT made an important contribution to monitoring disease activity during antibiotic treatment. (Nucl Med Mol Imaging 2007;41(6):570-573)

Key Words: aneurysm, aorta, CT, FDG-PET/CT, mycotic, salmonella

Introduction

Mycotic aneurysm is a rare and life-threatening disorder. CT is noninvasive imaging techniques that can detect aneurysm and changes in the surrounding structures.¹⁾

F-18 FDG (fluorodeoxyglucose) is not a tumor-specific tracer and focal accumulation of F-18 FDG is caused by enhanced glycolysis of activated neutrophils and macrophages at sites of infection or inflammation.²⁾ As has been reported, F-18 FDG PET would seem to hold promise for the diagnosis of focal infection or inflammation during the early phase.³⁾ Moreover, hybrid F-18 FDG PET/CT examinations served to permit better anatomical localization

of the PET findings. In addition, F-18 FDG PET/CT was more reliable than anatomical imaging in monitoring disease activity after treatment.⁴⁾

We present the case of infected aortic aneurysm due to salmonella enteritidis, and demonstrate the role of F-18 FDG PET/CT in the diagnosis and follow-up of patients for monitoring the response to antibiotic therapy.

Case Report

A 77-year-old male patient with diabetes mellitus and hypertension was admitted with 10 days of fever, chills, and abdominal pain.

On examination, his temperature was 38.4°C and blood pressure was 120/70 mmHg. Tenderness was over the umbilical region, without signs of peritoneal irritation. The white blood cell count was $9.2 \times 10^9/L$, with 77% neutrophils. The C-reactive protein (CRP) level was 12 mg/dl (normal range: 0-0.3 mg/dl). The abdominal x-ray revealed no significant finding. The abdominal CT scan showed saccular aneurysm below the renal arteries

- Received: 2007. 11. 30. • Accepted: 2007. 12. 14.
- Address for reprints: In Young Hyun, M.D., Department of Nuclear Medicine, Inha University College of Medicine, 7-206 Shinheung-dong, Jung-gu, Incheon 400-103, Korea
Tel: 82-32-890-3160, Fax: 82-32-890-3164
E-mail: iyhyun@inha.ac.kr
- ※ This work was supported by an Inha University research grant.

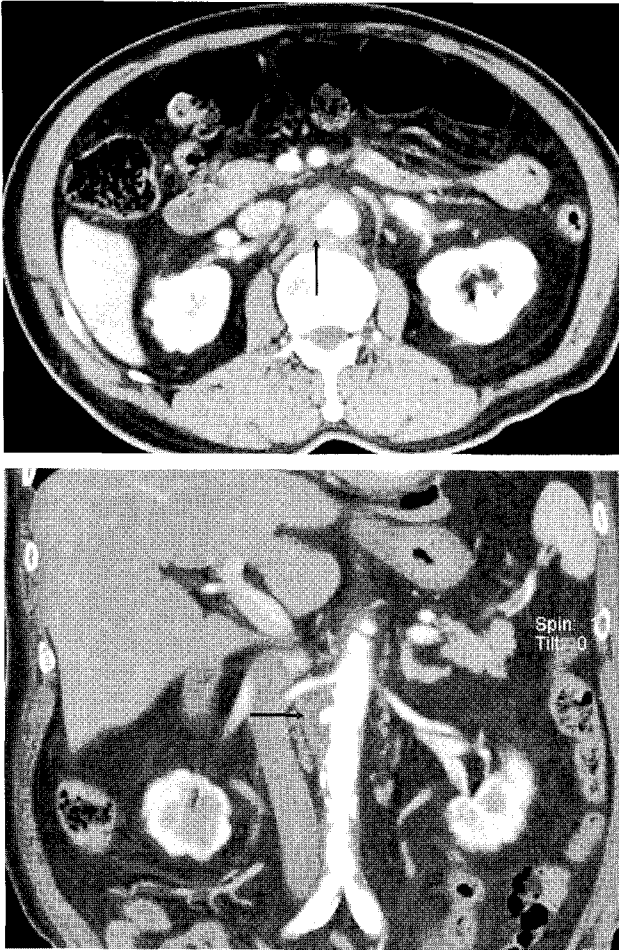


Figure 1. Contrast-enhanced axial and coronal CT images at the level of infra-renal aorta demonstrate saccular aneurysm (arrow) of the aorta, particularly of its right posterolateral lumen, with associated periaortic infiltration.



Figure 2. The axial and coronal images of F-18 FDG PET/CT show abnormal F-18 FDG hypermetabolism (maxSUV=6.53) in right wall of infrarenal abdominal aorta and periaortic space.

with periaortic soft tissue density (Fig. 1). F-18 FDG PET/CT was performed to assess vascular infection. Images were obtained starting 60 minutes after F-18 FDG administration with Siemens/Biograph Duo PET/CT scanner. Intense abnormal F-18 FDG accumulation was noted around right side of infrarenal aortic aneurysm (Fig. 2). However, leukocyte SPECT with Tc-99m HMPAO one day ago F-18 FDG PET/CT showed no abnormal uptake. Blood cultures yielded salmonella group D. These data suggested infected abdominal aortic aneurysm due to salmonella. Surgery was declined by the patient. He was treated with intravenous ciprofloxacin.

After 30 days of intravenous ciprofloxacin treatment, he left hospital in good condition with oral antibiotics. However, repeated CT scan on discharge demonstrated increased size of aneurysm and no change of periaortic soft

tissue density with enhancement (Fig. 3). One month after discharge from hospital, he was doing well; CRP was not elevated. By that time, repeated F-18 FDG PET/CT showed markedly decreased F-18 FDG accumulation around right side of infrarenal aortic aneurysm (Fig. 4). Until one year after discharge, there were no complications on clinical follow-up; a repeated F-18 FDG PET/CT (Fig. 5) showed nearly normalization of F-18 FDG uptake. We intend to keep on ciprofloxacin treatment.

Discussion

An infected aneurysms caused weakening or disruption of the aortic wall by an infectious process. Today, septic bacteremia is a frequent cause of infection of atheros-

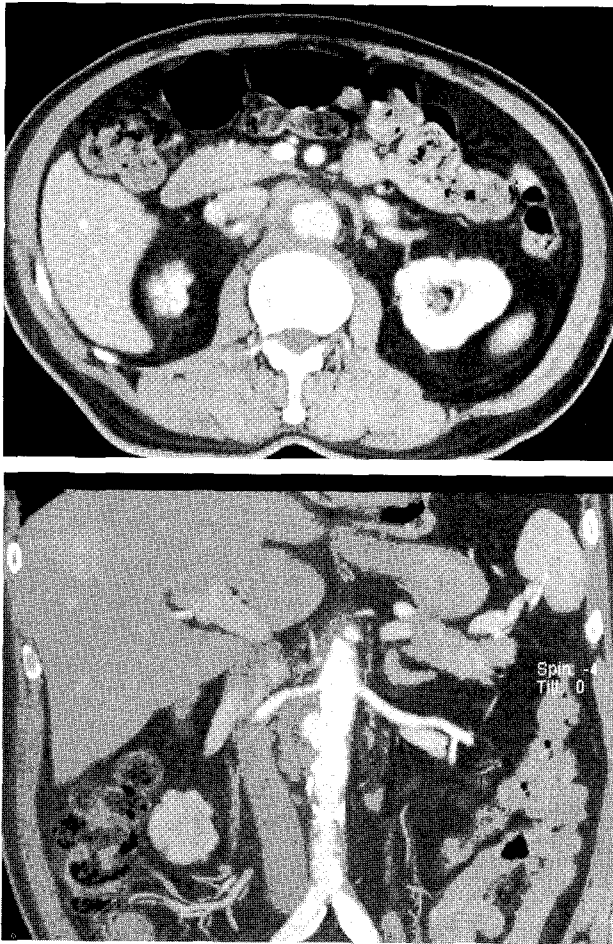


Figure 3. Repeat axial and coronal CT images at the same level, one month after antibiotics treatment, demonstrate increased size of aneurysm and no change of periaortic soft tissue density with enhancement.

clerotic arteries. Consequently, gram-negative organisms such as salmonella species have come to play an important role in aortic infection.^{5,6)} Atherosclerosis and immunosuppressive conditions such as diabetes mellitus, liver cirrhosis, and alcoholism are major predisposing factors.

CT scanning is usually performed to determine the cause of unexplained fever, abdominal pain, and a pulsatile abdominal mass. At present, CT scanning is considered to be the best diagnostic method because of its ability to demonstrate changes in the surrounding structures in aortic aneurysms. However, CT shows anatomical changes of the vessel lumen, inflammation of the vessel wall cannot be detected in an early phase due to the lack of substantial anatomical changes at this time.

Several reports have reported the uses of F-18 FDG

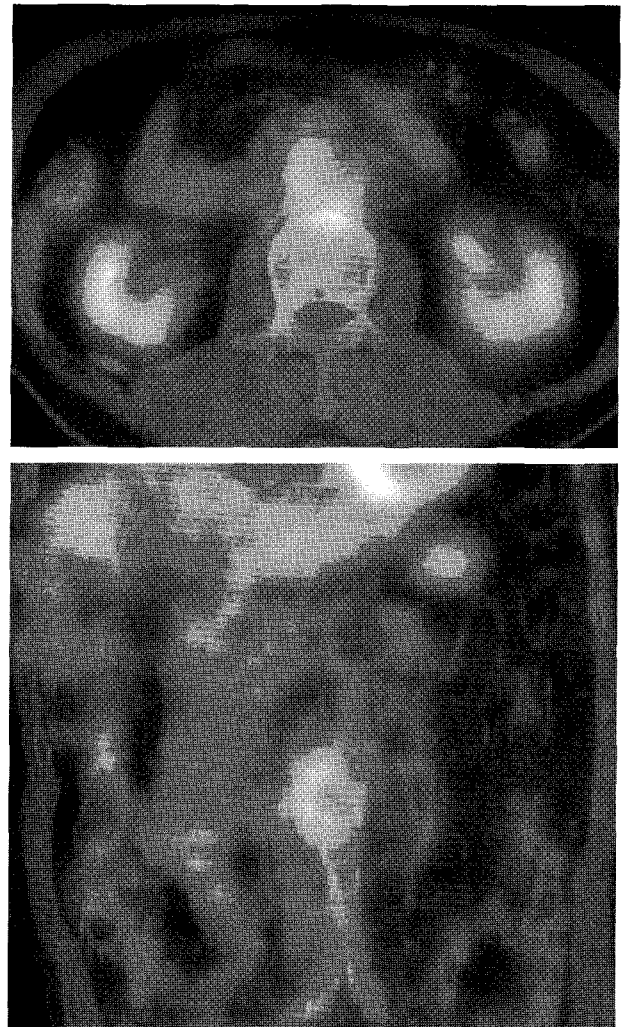


Figure 4. Repeat axial and coronal images of F-18 FDG PET/CT at the same level, one month after the first PET/CT, show decreased F-18 FDG uptake (maxSUV=3.61) in right wall of infrarenal abdominal aorta and periaortic space.

PET for diagnosing infectious vasculitis.⁷⁻⁹⁾ Because F-18 FDG accumulation is based on increased F-18 FDG uptake of cells with a high rate of glycolysis, F-18 FDG PET provides the opportunity to distinguish between inflammatory and non-inflammatory aneurysms.⁷⁾ Moreover, it could become a useful tool for monitoring vasculitis treatment and disease progression.⁴⁾

In our patient CT scanning was performed in 10 days after clinical presentation, CT features showed formation of saccular aneurysm. In addition to CT findings, elevated F-18 FDG uptake within the walls of aortic aneurysm on PET/CT suggested active vascular infection. In this case, blood cultures yielded salmonella. However, positive blood



Figure 5. F-18 FDG PET/CT one year after discharge shows nearly disappeared F-18 FDG uptake in the infrarenal abdominal aorta.

cultures are reported in only 53% of cases.¹⁰⁾ In cases with negative blood cultures, elevated F-18 FDG uptake within the walls of aortic aneurysm contributed to the diagnosis of infected aortic aneurysm.

In our case, the leukocyte scan showed no abnormal uptake. This discrepancy was also reported in other study about vasculitis.¹¹⁾ This suggests that F-18 FDG PET has superiority over the leukocyte scan in diagnosis of focal infection.

In monitoring disease activity, normalization of F-18 FDG uptake clearly correlated with clinical improvement and normalization of the laboratory findings.⁴⁾ In our patient, the patient was asymptomatic with antibiotic therapy after 1 month. However, repeated CT scanning remained unchanged. In contrast, F-18 FDG PET/CT during follow-up, showed markedly decreased F-18 FDG

uptake. The change of F-18 FDG uptake correlated with clinical improvement and normalization of the laboratory findings. These findings may indicate a more rapid response of F-18 FDG uptake to successful therapy compared with the more delayed changes of morphology that are visualized by CT.⁴⁾ One year after discharge, our patient is doing well with only antibiotic treatment. A repeated F-18 FDG PET/CT showed normalization of F-18 FDG uptake. In our patient, F-18 FDG PET can help clinicians to monitor disease activity after treatment.

Although CT is an effective technique for diagnosis of infected aortic aneurysm, our case demonstrates that F-18 FDG PET/CT is used for diagnosing infectious vasculitis. This report also suggests that F-18 FDG PET is more reliable than CT in monitoring disease activity during antibiotics therapy.

References

- Gomes MN, Choyke PL, Wallace RB. Infected aortic aneurysms. A changing entity. *Ann Surg* 1992;215:435-42.
- Yamada S, Kubota K, Kubota R, Ido T, Tamahashi N. High accumulation of fluorine-18-fluorodeoxyglucose in turpentine-induced inflammatory tissue. *J Nucl Med* 1995;36:1301-6
- Jaruskova M, Belohlavek O. Role of FDG-PET and PET/CT in the diagnosis of prolonged febrile states. *Eur J Nucl Med Mol Imaging* 2006;33:913-8.
- Meller J, Strutz F, Siefker U, Scheel A, Sahlmann CO, Lehmann K, et al. Early diagnosis and follow-up of aortitis with [(18)F]FDG PET and MRI. *Eur J Nucl Med Mol Imaging* 2003;30:730-6.
- Kario K, Mizuno Y, Kanatsu K, Tankawa H, Ikeda M. Infected abdominal aortic aneurysm due to salmonella: CT evaluation. *Clinical Imaging* 1991;15:261-4.
- Carreras M, Larena JA, Tabernero G, Langara E, Pena JM. Evolution of salmonella aortitis towards the formation of abdominal aneurysm. *Eur Radiol* 1997;7:54-6.
- Hoogendoorn EH, Oyen WJ, van Dijk AP, van der Meer JW. Pneumococcal aortitis, report of a case with emphasis on the contribution to diagnosis of positron emission tomography using fluorinated deoxyglucose. *Clin Microbiol Infect* 2003;9:73-6.
- Kösters K, Bleeker-Rovers CP, van Crevel R, Oyen WJ, van der Ven AJ. Aortitis diagnosed by F-18-fluorodeoxyglucose positron emission tomography in a patient with syphilis and HIV coinfection. *Infection* 2005;33:387-9.
- Davison JM, Montilla-Soler JL, Broussard E, Wilson R, Cap A, Allen T. F-18 FDG PET-CT imaging of mycotic aneurysm. *Clin Nucl Med* 2005;30:483-7.
- Mendelowitz DS, Ramstedt R, Yao JS, Bergan JJ. Abdominal aortic salmonellosis. *Surgery* 1979;85:514-9.
- Ioannidis JP, Merino F, Drapkin MS, Lew MA, Cohn LH. Pneumococcal aortitis in the antibiotic era. *Arch intern Med* 1995;155:1678-80.