Gen Thorac Cardiovasc Surg (2016) 64:549–551
DOI 10.1007/s11748-014-0516-5

CASE REPORT

Surgical strategy for aortic prosthetic graft infection with ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography

Katsuhiro Yamanaka · Takashi Matsueda · Shunsuke Miyahara · Yoshikatsu Nomura · Toshihito Sakamoto · Naoto Morimoto · Takeshi Inoue · Masamichi Matsumori · Kenji Okada · Yutaka Okita

Received: 15 August 2014 / Accepted: 16 December 2014 / Published online: 8 January 2015

Abstract A 30-year-old man with Marfan syndrome who underwent Crawford type II extension aneurysm repair about 9 years ago was referred to our hospital with persistent fever. Computed tomography (CT) showed air around the mid-descending aortic prosthetic graft. Because the air did not disappear in spite of intravenous antibiotics, ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) was performed. FDG-PET/CT revealed four high-uptake lesions. After dissecting the aortic graft particularly focusing on the high-uptake lesions, this patient underwent in situ graft re-replacement of descending aortic graft with a rifampicin-bonded gelatin-impregnated Dacron graft and omentopexy. The patient remains well without recurrent infection at 3 months after surgery.

Keywords Graft infection · ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography · Thoracoabdominal aortic aneurysm

Introduction

Aortic prosthetic graft infection is a rare but serious complication. The resection area becomes very difficult to define if multiple prosthetic grafts are implanted or if the aorta is extensively replaced. We present a case of aortic graft infection after thoracoabdominal aortic aneurysm (TAAA) repair of Crawford extent II using FDG-PET/CT effectively.

K. Yamanaka · T. Matsueda · S. Miyahara · Y. Nomura · T. Sakamoto · N. Morimoto · T. Inoue · M. Matsumori · K. Okada · Y. Okita (✉)
Division of Cardiovascular Surgery, Department of Surgery, Kobe University Graduate School of Medicine, 7-5-2 Kusunoki-Cho, Chuo-ku, Kobe 650-0017, Japan
e-mail: yokita@med.kobe-u.ac.jp

K. Yamanaka
e-mail: yamakachubanzai@gmail.com

Case

A 30-year-old man with Marfan syndrome was referred because of TAAA. This patient had undergone TAAA repair of Crawford extent II successfully. The intercostal arteries at the levels of Th8, Th9, Th10 and Th11 had been reattached by the graft interposition, and the visceral arteries were reattached using the island technique (Fig. 1). He developed high-grade fever of unknown origin 2, 4, and 8 years after TAAA repair, and had been treated with intravenous antibiotics at another hospital. This patient was transferred to our institution 9 years after TAAA repair with suspected aortic prosthetic graft infection due to presenting with pyrexia and blood cultures that were positive for *Moraxella catarrhalis*. Air around the mid-descending aorta was identified by CT (Fig. 1). A little fluid was seen near the celiac artery and the mid-descending aorta by CT. The level of C-reactive protein (CRP) was 1.93 mg/dL and the white blood cell count was 4400/μL.

Although intravenous antibiotics improved the pyrexia and returned to CRP level to normal within 4 weeks, the air around the mid-descending aortic graft persisted. High-uptake lesions on FDG-PET/CT were seen around the proximal anastomosis to the aortic arch (Fig. 2a), the mid-descending aortic graft (Fig. 2b), the abdominal aortic graft at the level of celiac artery (Fig. 2c) and the distal anastomosis to the terminal aorta (Fig. 2d). The maximal standardized uptake values (SUV_{max}) in these areas were 5.85, 4.43, 7.78 and 6.5, respectively.

At surgery we dissected the prosthetic aortic grafts, particularly focusing on the high-uptake lesions detected by FDG-PET/CT. The abscess was localized around the mid-descending aortic graft (Fig. 3). We resected the mid-descending aortic graft, including the interposed grafts which were reattached to the intercostal arteries at the level of Th8, Th9, Th10 and Th11. After debridement, in situ graft re-replacement of the descending aorta and the reconstruction of the patent intercostal artery at the Th8 level with a rifampicin-bonded gelatin-impregnated Dacron graft and omentopexy were performed. Intraoperative microscopic study confirmed that the proximal and distal ends of the resected aortic graft were free of infection. The postoperative course was uneventful. Histopathological examination of the resected aortic graft revealed considerable neutrophil infiltration and no bacteria. Culture of resected aortic graft was negative. This patient remains free of recurrent infection at 3 months after surgery.

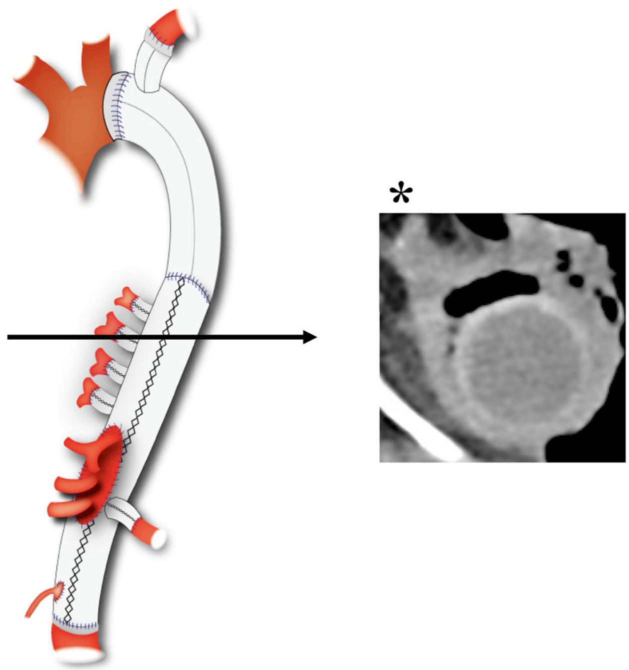

Fig. 1 After Crawford type II extension aneurysm repair. Preoperative computed tomography showed air around the mid-descending aorta (*asterisk*)

Discussion

Aortic prosthetic graft infection is associated with very high morbidity and mortality. Surgical treatment is essential, but very challenging in patients who are often critically ill. Although graft infection requires appropriate diagnosis, it is not easily obtained, as clinical signs are nonspecific. The gold standard for diagnosing prosthetic graft infection has been CT. However, the major disadvantage of CT is that sensitivity decreases in the presence of low-grade prosthetic graft infection [1]. FDG-PET/CT has

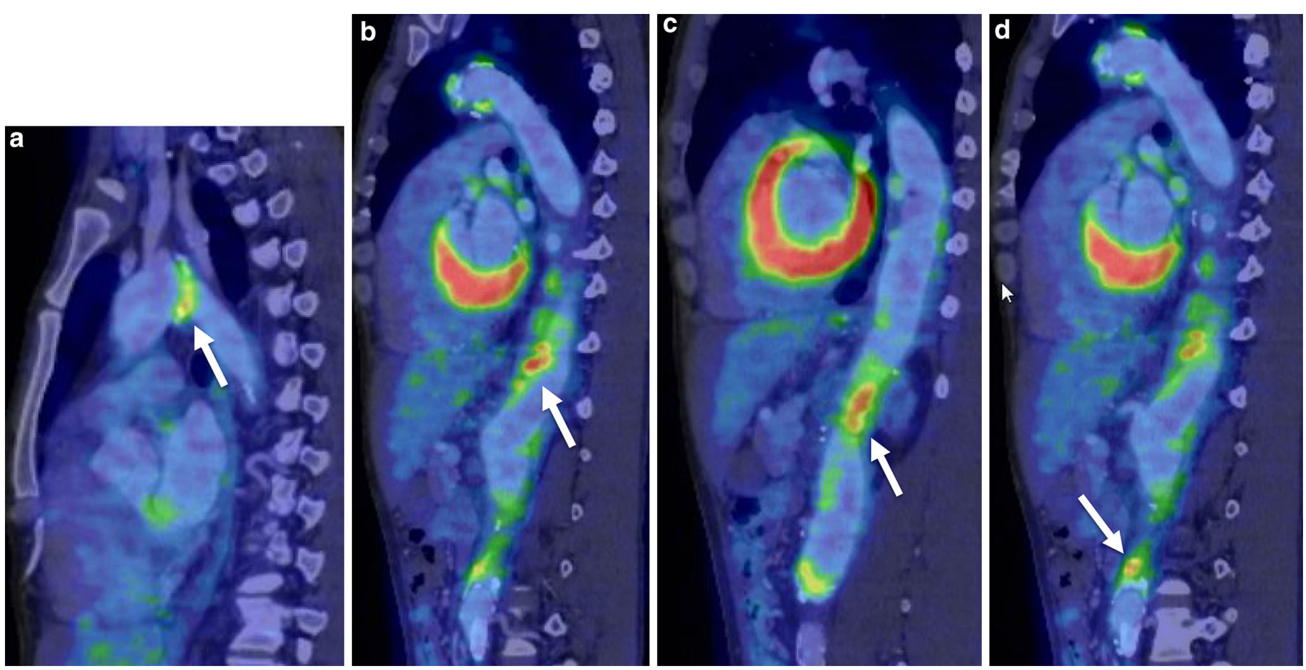

Fig. 2 Preoperative ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography findings (sagittal plane). Proximal anastomosis (**a**), mid-descending aortic graft (**b**), abdominal aortic graft at the level of celiac artery (**c**), distal anastomosis (**d**)

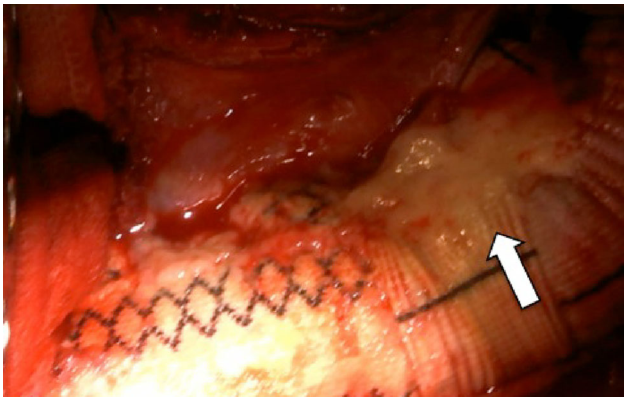

Fig. 3 Localized abscess

recently been used in the diagnosis of infectious disease. The standardized uptake value (SUV) is commonly applied as a relative measure of ^{18}F-FDG uptake, in which areas of maximal focal ^{18}F-FDG uptake are visually detected, and the SUV_{max} in each area is measured. Tokuda and colleagues [2] reported that FDG-PET/CT was useful to promptly and precisely confirm the presence of graft infection. They stated that SUV_{max} greater than 8 around a graft suggested the presence of graft infections (sensitivity 1.0 and specificity 0.8).

However, SUV is affected by factors such as physique, blood glucose level, renal function and the uptake duration between the injection and scan [3, 4]. The SUV is variable. To overestimate the SUV is very dangerous. Moreover, not only infection, but also various types of inflammation, can cause high uptake because FDG-PET/CT is based on the uptake of radio-active-labeled glucose in metabolically active cells. Keidar et al. [5] reported that ^{18}F-FDG uptake was found in 92 % of noninfected vascular prostheses because of foreign body response, and the intensity of ^{18}F-FDG uptake of prosthetic grafts did not change over time.

The role of CT in diagnosing vascular prosthetic graft infection has been widely investigated. Several characteristic features of vascular prosthetic graft infection with CT are perigraft air, fluid, and soft tissue attenuation, pseudoaneurysm, focal bowel thickening, and discontinuation of the aneurysmal wall [1]. When multiple prosthetic grafts were implanted or extended replacement of aorta was performed, it was impossible to determine the resection area only by CT. Moreover, it took a huge amount of effort to dissect all of the prosthetic grafts. However, resecting all of the infected grafts is mandatory [6]. In our case, we dissected the aortic graft efficiently by focusing on the high-uptake lesions on FDG-PET/CT. We finally determined resection areas based on the intraoperative findings and on intraoperative microscopic examination. Thus, FDG-PET/CT was useful as a tool for preparing the surgical strategy. Tissue culture of this patient was negative and this might have resulted from high doses of intravenous antibiotics before surgery.

Conclusions

We experienced a case of aortic graft infection after TAAA repair of Crawford extent II using FDG-PET/CT effectively. FDG-PET/CT is useful not only as a diagnostic modality but also as a tool for selecting optimal surgical strategy.

Conflict of interest Katsuhiro Yamanaka and other co-authors have no conflict of interest.

References

1. Bruggink JL, Slart RH, Pol JA, Reijnen MM, Zeebregts CJ. Current role of imaging in diagnosing aortic graft infections. Semin Vasc Surg. 2011;24(4):182–90.
2. Tokuda Y, Oshima H, Araki Y, Narita Y, Mutsuga M, Kato K, et al. Detection of thoracic aortic prosthetic graft infection with ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography. Eur J Cardiothorac Surg. 2013;43:1183–7.
3. Kinahan PE, Fletcher JW. Positron emission tomography-computed tomography standardized uptake values in clinical practice and assessing response to therapy. Semin Ultrasound CT MR. 2010;31(6):496–505.
4. Bille A, Girelli L, Leo F, Pastorino U. A false positive fluorodeoxyglucose lymphadenopathy in a patient with pulmonary carcinoid tumor and previous breast reconstruction after bilateral mastectomy. Gen Thorac Cardiovasc Surg. 2014;62(3):195–7.
5. Keidar Z, Pirmisashvili N, Leiderman M, Nitecki S, Israel O. ^{18}F-FDG uptake in noninfected prosthetic vascular grafts: incidence, patterns, and changes over time. J Nucl Med. 2014;55:392–5.
6. Yamanaka K, Omura A, Nomura Y, Miyahara S, Shirasaka T, Sakamoto T, et al. Surgical strategy for aorta-related infection. Eur J Cardiothorac Surg. 2014;46:974–80.