

Difficult diagnosis and management of a complicated Nellix graft infection

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ABSTRACT

An 81-year-old man, with a complex vascular surgical history, presents with sepsis from an infected Nellix stent-graft. He required an urgent laparotomy, explantation of the graft, and extra-anatomical repair. Although now widely used for this indication, the preoperative 18F-fluorodeoxyglucose positron emission tomography/computed tomography was non-diagnostic for his stent-graft infection. We describe our management of a complicated Nellix graft infection and discuss the utility of positron emission tomography/computed tomography for stent-graft infections. (J Vasc Surg Cases Innov Tech 2021;7:417-20.)

Keywords: Nellix; Infected stent-graft; Complications

Endovascular aneurysm repair (EVAR) is the preferred technique for the treatment of abdominal aortic aneurysms (AAA). Endovascular aneurysm sealing with the Nellix stent-graft is a newer technique that uses polymer-filled endo-bags to obliterate and seal the aneurysm sac.¹ This aims to mitigate type 2 endoleaks that are associated with late failures with EVAR.²

Endograft infections are rare but life-threatening complications with an incidence of 0.2%-0.7% and mortality rates up to 50%.^{3,4} Incidence rates of 0.6%-1.2% have been reported for Nellix stent-grafts.⁵⁻⁷ In the literature to date, there are three published case reports describing the management of Nellix stent-graft infections.^{8,9}

Diagnosing stent-graft infection is challenging. Computed tomography (CT) and 18F-fluorodeoxyglucose positron emission tomography (FDG-PET) are frequently used in combination.⁴ We describe the management of a complicated Nellix stent-graft infection where FDG-PET/CT was difficult to interpret. The patient's consent was gained for this case report.

CASE REPORT

An 81-year-old diabetic gentleman presented with 2 days of rigors. On examination, he was febrile (39.3°C), tachycardic (145 bpm), and had a tender, pulsatile mass in the left iliac fossa. His background includes endovascular aneurysm sealing for a 6 cm AAA 6 years prior, with a subsequent relining 2 years later with

a Lifestream balloon-expandable stent due to proximal migration. Thirteen months ago, he underwent left-to-right femoral-femoral crossover (expanded polytetrafluoroethylene) bypass for an occluded right-graft limb. This was explanted 3 months later after a left-groin abscess. Microbiology was positive for pan-sensitive *Staphylococcus aureus*. He was commenced on lifelong oral flucloxacillin but represented 6 months later with a left common femoral artery mycotic aneurysm. This was excised and reconstructed with an external iliac (EIA) to superficial femoral artery bypass using a superficial femoral vein graft. Microbiology was negative, and he was treated with 2 weeks of intravenous (IV) flucloxacillin and then lifelong oral co-trimoxazole.

Follow-up CT angiography (CTA), 3 months later, revealed a 26 mm, possible mycotic dilatation of the left EIA. The left limb of the Nellix stent-graft terminates at the proximal aspect (Fig 1, A). FDG-PET/CT appearance of the stent-graft and aneurysm sac was unremarkable (Fig 2, A), but mild uptake in the EIA aneurysm was seen (SUVmax of 5.4) (Fig 2, B).

He presented acutely 3 weeks later. He had a C-reactive protein of 82 mg/L, white cell count of $3.77 \times 10^9/L$, and negative peripheral blood cultures. IV flucloxacillin and gentamicin were commenced. CTA demonstrated progression of the left EIA aneurysm up to 36 mm (Fig 1, B) with associated focal outpouching of the vessel wall and significant soft tissue stranding, concerning for impending rupture.

He was taken for a laparotomy and the stent-graft was explanted. The anterior wall of the infrarenal aorta, left common iliac artery, and proximal EIA were involved in the inflammatory process and excised. The Nellix stent-graft and endo-bag contents were immersed in dark, turbid fluid (Fig 3). The initial plan for a rifampicin-soaked aortic reconstruction was abandoned given the poor tissue integrity. The aortic and iliac stumps were oversewn, and extra-anatomical reconstruction with a left axillofemoral bypass (expanded polytetrafluoroethylene) was done. The right side was chronically occluded and perfused via collaterals.

The stent-graft, sac fluid, iliac artery thrombus, and wall were negative for microbiology. 16S-RNA bacterial sequencing was also negative. Infectious diseases consultation recommended

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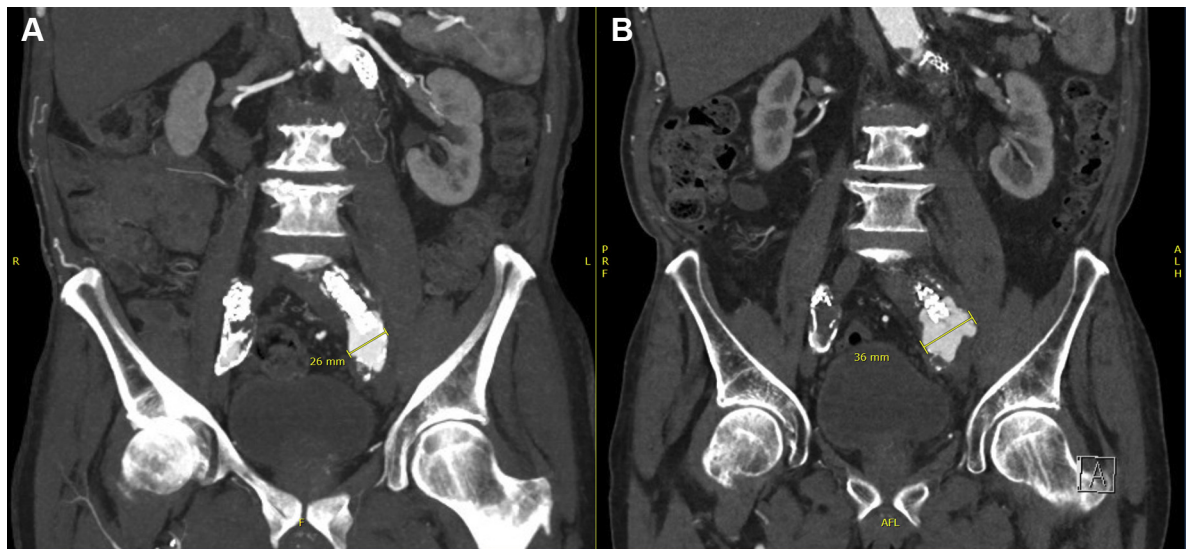


Fig 1. CTA coronal views. **A**, Left EIA aneurysm 3 weeks prior. **B**, Left EIA aneurysm on current admission. CTA, Computed tomography angiography; EIA, external iliac artery.

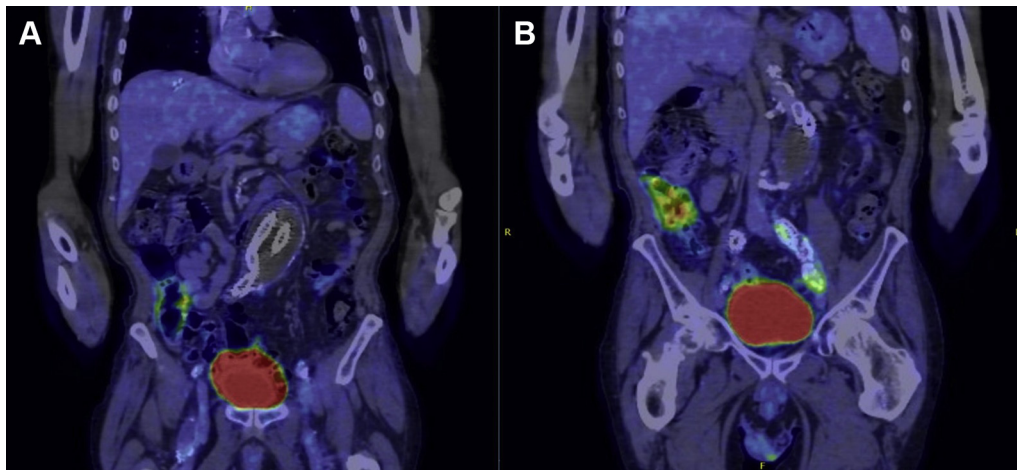


Fig 2. FDG-PET/CT coronal views. **A**, No uptake seen in the Nellix stent graft. **B**, FDG uptake in the left EIA. CT, Computed tomography; EIA, external iliac artery; FDG-PET, 18F-fluorodeoxyglucose positron emission tomography.

6 weeks of IV piperacillin/tazobactam followed by lifelong oral cotrimoxazole. He was discharged 17 days postoperatively. Unfortunately, he re-presented 3 months later with critical limb ischemia and tissue loss due to occlusion of his axillofemoral graft and subsequently underwent a left above-knee amputation.

DISCUSSION

Aortic endograft infections are rare but carry significant morbidity and mortality. Risk factors include obesity, diabetes, immunodeficiency, perioperative infections, and emergency or secondary procedures.^{10,11} Common causative organisms are *Staphylococcus* and *Streptococcus*, but gram-negatives such as *Escherichia coli*, *Enterobacter cloacae*, and *Pseudomonas aeruginosa* have also been

implicated.¹² This case report presents the emergency management of a complicated Nellix stent-graft infection.

The diagnosis of infected stent-grafts is challenging, with variable presentations.^{11,13} Inflammatory markers are often nonspecific.¹¹ Blood cultures are positive in only 20%-30% of cases,¹⁴ and cultures of explanted graft tissue are negative in approximately one-third of cases. This is thought to be related to prior antibiotic use.^{12,15,16}

The Management of Aortic Graft Infection Collaboration (MAGIC) described a diagnostic criterion for aortic graft infections based on clinical, radiological, and laboratory criteria.¹⁷ The major radiological criteria included CT findings of gas or perigraft fluid, whereas FDG-PET/CT was considered a minor criterion. This is because they are difficult to interpret due to false positives from



Fig 3. Explanted Nellix stent-graft with turbid fluid around and in the endo-bags.

low-grade inflammation associated with prosthetic grafts.¹⁷ Recent work by Jebbink et al,⁴ however, suggests that this may be different for the Nellix graft. They found decreased FDG uptake at 6 weeks after deployment in noninfected Nellix stent-grafts and suggest that early inflammation may be less of an issue compared with EVAR. PET-CT may, therefore, have a higher positive predictive value for infected Nellix stent-grafts compared with other EVAR systems.

The reported sensitivity and specificity of FDG-PET/CT for graft infections are up to 91% and 64%, respectively.¹⁸ Evidence for stent-graft infections is limited, but a recent study reported a sensitivity of 89% and a specificity of 100%,¹⁴ which suggests that it is a reliable investigation for this indication. Also, focal avidity on PET may be detected before significant gas or fluid is seen on CT.¹⁹ Recent guidelines from the European Society for Vascular surgery recommend both CTA and FDG-PET/CT for the diagnosis of graft infections.²⁰

FDG-PET/CT interpretation is based on FDG uptake and the maximum standard uptake value (SUVmax).¹⁴ Focal, heterogeneous uptake is suggestive of infection, as opposed to homogeneous, diffuse uptake.¹⁰ SUVmax threshold values are based on single-center case studies with no consensus on cutoffs, and values of 5.6-8 have been reported in graft infections.^{14,21,22} Despite the intraoperative findings of a clearly infected stent-graft, our patient's PET-CT only had an SUVmax of 5.4 in the EIA aneurysm with no visible uptake along the main graft. This may be due to our patient's prolonged antibiotic course, resulting not only in negative cultures but also in reducing metabolic activity and therefore FDG uptake.^{19,23} Another explanation may be due to the specific design of the Nellix graft, with the avascular space of the high-pressure endo-bags resulting in less viable tissue for FDG penetration. Lastly, the infection may have originated and ascended from the left groin rather than from the aorta, in which case the PET-CT may have been too early to visualize the aortic infection.

Of the three other case reports of Nellix graft infections, two used FDG-PET/CT.⁸ Neither were on antibiotics prior, and both cases demonstrated high uptake along the aortic wall (SUVmax 7.2 and 9.7), which differs from our case. The former was initially managed as periaortitis but represented with a ruptured AAA necessitating emergency explant and reconstruction. The latter was associated with an aortoenteric fistula and was managed emergently.⁸ These cases, along with ours, highlight the need to clarify the utility and interpretation of PET/CT in the workup of Nellix stent-graft infections, particularly for patients previously treated with antibiotics.

CONCLUSIONS

We describe the case of an infected Nellix stent-graft presenting acutely and requiring an emergency explant. This case describes the typical management of an infected aortic stent-graft to aid management of similar cases in the future.

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