Late prosthetic graft infection after frozen elephant trunk presenting by haemoptysis and positive $^{18}$F-fluorodeoxyglucose-positron emission tomography/computed tomography

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Abstract

In cardiothoracic surgery, prosthetic graft infection represents a diagnostic and therapeutic challenge. Although clinical assessment, imaging techniques and microbiological investigations are helpful, late graft infection can be difficult to identify using classical diagnostic tools. An aggressive surgical approach involving removal and replacement of all prosthetic materials is technically demanding but remains the best strategy to eradicate infection. Herein, we report a case of a late aortic graft infection, after frozen elephant trunk implantation with atypical presentation, diagnosed with $^{18}$F-fluorodeoxyglucose-positron emission tomography and treated successfully through a radical surgical strategy. This case emphasizes the emerging diagnostic role of positron emission tomography and encourages the adoption of an aggressive surgical approach.

Keywords: Aortic graft infection • $^{18}$F-fluorodeoxyglucose-positron emission tomography

INTRODUCTION

Prosthetic graft infection involving the aortic arch puts surgeons face to face with both diagnostic and therapeutic challenges, especially in the case of previous surgery or extended infection into the aortic root or the descending aorta. Diagnosis of aortic graft infection (AGI) is made on the basis of clinical, radiological and microbiological investigations. However, the presentation of late-onset infections tends to be subtle, which routine imaging could fail to identify. Recently, $^{18}$F-fluorodeoxyglucose-positron emission tomography coupled with computed tomography (CT) ($^{18}$FDG-PET-CT) has made a valuable diagnostic contribution in various clinical fields, including cardiovascular medicine. However, application of $^{18}$FDG-PET-CT in cardiac surgery is still in its infancy.

There are no established guidelines for managing extensive thoracic AGI. Depending on the patient’s frailty, complexity of the procedure and the strength of evidence of an infection, the treatment strategy is usually tailored specifically to the individual patient [1]. Complete removal of the infected prosthetic material and its replacement with a new graft is particularly challenging when the infection involves the aortic root and the aortic arch. Therefore, many surgeons tend to salvage existing grafts through a regimen of aggressive debridement, irrigation and coverage [2]. However, leaving the old prosthesis in an infected surgical field makes it difficult to eradicate the infection. In the absence of evidence-based practice guidelines, the best management strategy of AGI remains controversial.

CASE REPORT

A 73-year old lady was admitted to the department of internal medicine for recurrent haemoptysis. Her past history included a Bentall procedure, total arch replacement and implantation of a frozen elephant trunk 2 years earlier. A lung tumour was suspected and CT scan revealed a lesion in the left upper lobe (Fig. 1A). For further confirmation, an $^{18}$FDG-PET–CT was performed and suggested an infection of the prosthesis. Standardized uptake values were as follows: aortic root (7.7), ascending aorta (6.9) and aortic arch including the proximal portion of the frozen elephant trunk (5.97) (Fig. 1B and C). A transoesophageal echocardiography showed no evidence of endocarditis. Blood cultures were negative with normal levels of inflammatory markers. To confirm the infection and rule out an erosion of the lung, an atypical resection of the left upper lobe was performed via a left lateral thoracotomy. Neither histology nor microbiological examination of the intraoperative material could confirm an infection; nor could the intraoperative macroscopic finding. After an asymptomatic period of 2 months, the patient was again admitted for haemoptysis and the decision for surgery was made. Surgery revealed a valve endocarditis and an infection involving the whole prosthesis (Fig. 1D and E). Through sternotomy and cardiopulmonary bypass, extensive aortic root debridement was performed; the aortic arch and proximal descending aorta were replaced with a homograft from the descending aorta under deep hypothermic circulatory arrest, and the aortic root was then replaced during rewarming with an aortic root homograft. The cross-clamping time was 236 min; bypass time was 322 min and surgery time was 8.5 h. The patient was extubated on the first postoperative day and...
remained in the intensive care unit for 5 days. Microbiological examination of the intraoperative material revealed a *Staphylococcus epidermidis* infection. Except for the implantation of a pacemaker for postoperative atrial ventricular block, the postoperative recovery was uneventful. The patient was discharged on the 17th postoperative day. Appropriate antibiotic therapy was continued up to 6 weeks postoperatively. After 6 months, the patient was in good condition and without symptoms.

**DISCUSSION**

AGI after surgery to reconstruct the thoracic aorta is a devastating complication characterized by high mortality. Diagnosis and treatment of this complication remains a challenge for the physicians involved. Infections associated with vascular grafts can be diagnosed with CT or magnetic resonance imaging (MRI). In some cases, the sensitivity of CT and MRI decrease because of post-surgery morphological changes that appear similar to inflammatory changes and make it difficult to confirm infection. 18F-DG-PET has proved useful in the diagnosis and evaluation of inflammation and infection at different organ sites [3]. Combining CT with 18F-DG-PET increases its accuracy. A recent study highlights the possible role of PET–CT in detection of AGI, especially when the clinical presentation and conventional imaging findings are non-specific [4]. In the case reported here, the clinical presentation was atypical without signs of infections and with negative blood culture. Classical CT failed to detect an extensive graft infection but suggested a lung tumour, whereas an 18F-DG-PET–CT suggested infection of the prosthesis, which was confirmed by surgery. In addition to unmask the infection, the performed PET–CT provided details regarding the extent of infection and allowed us to plan our surgical strategy.

Little evidence is available to guide surgeons in treating patients with thoracic AGI. However, beyond the well-established principles of surgical debridement, antiseptic irrigation and appropriate antibiotic therapy, the accumulated expert opinion illustrates two main options to face this problem: salvaging the original graft or graft removal and replacement with a synthetic graft or tissue graft [1]. Good outcome could be achieved with a graft-sparing strategy in cases associated with sternal wound sepsis and with a limited extent of the infection. A recent review [5] recognized various cases of infected ascending/arch prosthetic grafts treated with open surgical disinfection followed by omentum flap coverage, with good

**Figure 1:** (A) CT revealed a lesion in the left upper lobe. (B and C) 18F-DG-PET–CT suggested an infection of the prosthetic material. (D and E) Surgery revealed a valve endocarditis and an infection of all the prosthetic material. CT: computer tomography; 18F-DG-PET–CT: 18F-fluorodeoxyglucose-positron emission tomography coupled with CT.
outcomes in terms of early survival rate and non-recurrence of graft infection. However, data regarding late outcomes are not available. Furthermore, the additional trauma of the laparotomy associated with a wrapping technique and the risk of introducing infection into the abdomen could not be ignored. In our patient, a conservative approach was inappropriate. Removal of all infected material and reconstruction of the aorta were necessary due to the extension of infection to the elephant trunk and persistence of haemoptysis. We preferred a homograft to avoid introduction of new foreign material. Our surgical approach guaranteed complete removal of an extended infected prosthetic graft, with complete infection eradication and a good mid-term result.

CONCLUSION

\(^{18}\text{FDG-PET-CT}\) seems to be a very useful tool in the diagnosis of late graft infection and should be considered in doubtful cases. The technically challenging nature of a surgical approach in cases of extended graft infection should not impede the decision to undertake surgical correction.

Conflict of interest: none declared.

REFERENCES

[3] Millar BC, Prendergast BD, Alavi A, Moore JE. \(^{18}\text{FDG-positron emission tomography (PET) has a role to play in the diagnosis and therapy of infective endocarditis and cardiac device infection. Int J Cardiol 2013;167:1724–36.}\)