Diagnosis of Prosthetic Aortic Valve Endocarditis With Gallium-67 Citrate Single-Photon Emission Computed Tomography/Computed Tomography Hybrid Imaging Using Software Registration

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Prosthetic valve endocarditis can be challenging to diagnose and is associated with high mortality rates even if recognized and managed early. We present a case of staphylococcal sepsis soon after aortic valve surgery and permanent pacemaker implantation for which conventional investigation with echocardiography and computed tomography (CT) failed to identify an infective focus. Subsequent gallium–single-photon emission CT (67Ga-SPECT) imaging with software registration of the SPECT data helped to correctly identify the prosthetic aortic valve as the source of sepsis, with resolution of changes on subsequent imaging.

A 70-year-old woman underwent bioprosthetic aortic valve replacement and coronary artery bypass grafting for symptomatic severe aortic stenosis and significant 2-vessel coronary disease. Her postoperative course was complicated by significant bradycardia necessitating dual-chamber permanent pacemaker implantation.

She presented 3 months after surgery in a confused state, with low-grade pyrexia. The examination identified a soft systolic aortic murmur but no diastolic component, normal breath sounds, absence of cutaneous markers of endocarditis, and no evidence of wound infection. Blood tests showed a normal white cell count but markedly raised inflammatory markers. Brain CT was unremarkable. Transthoracic echocardiography revealed good biventricular systolic function and satisfactory appearances to the prosthesis and pacing wires. Serial blood cultures identified a persistent coagulase-negative staphylococcal bacteremia. Transthoracic echocardiography (Figure 1A; see online-only Data Supplements).

Figure 1. A, Transthesophageal echocardiography (Omniplane II probe, HP Sonos 5500 Ultrasound System, Best, The Netherlands) images of aortic bioprosthesis in the long-axis, color-flow mapping of the prostheses open and en face revealing normal prosthetic appearances (arrow), and no evidence of vegetation or periaortic root infection. Bottom: B, Coronal, axial, and sagittal views from CT thorax revealing normal postoperative CT (Aquilion 64, Toshiba Medical Systems, Tokyo, Japan) appearances and no aortic root or mediastinal collection. LA indicates left atrium; AoV, aortic valve; Ao, aortic root; and LV, left ventricle (also see Movies I and II online-only Data Supplements).
Data Supplements Movies I and II) imaging of the aortic prosthesis, undertaken on strong clinical suspicion of either pacemaker lead or prosthetic valve endocarditis, demonstrated normal appearance and function of the aortic root and prosthesis, with no evidence of valvular or lead vegetations. Multidetector contrast-enhanced CT of the thorax, abdomen, and pelvis was normal, with no features of mediastinitis (Figure 1B).

For further clarification, a $^{67}\text{Ga}$ scintigraphic study was performed, including planar and SPECT imaging (Philips Skylight dual-head $\gamma$ camera, Phillips Medical Systems, Milpitas, Calif). SPECT images of the chest taken at 48 hours revealed a clear focus of pathologically increased uptake behind the sternum (Figure 2). Software coregistration of CT and SPECT studies was performed on a Hermes workstation (Nuclear Diagnostics, Stockholm, Sweden), using a mutual information algorithm and 9 degrees of freedom. This identified the area of abnormality seen on the gallium scan as precisely localizing to the aortic prosthesis (Figure 2), strongly supporting a diagnosis of prosthetic valve infective endocarditis. The patient responded well to a prolonged course of intravenous vancomycin and oral rifampicin. Follow-up $^{67}\text{Ga}$-SPECT/CT study at 4 months confirmed complete resolution of the area of abnormal uptake seen in the previous study (Figure 3). She remains clinically well off antibiotics.

The use of functional imaging with $^{67}\text{Ga}$-citrate has a role in the assessment of difficult cases of suspected infective endocarditis but can be limited by definition and anatomic resolution of scintigraphic findings. We took the volume data obtained from $^{67}\text{Ga}$-SPECT and coregistered it with routine contrast-enhanced CT images to yield hybrid fusion images accurately delineating the presence of aortic prosthetic involvement by infection. There is growing support for the superiority of this approach of integrating functional and morphological data in improving both reporter confidence and diagnostic accuracy of SPECT in a broad range of infectious, inflammatory, and neoplastic settings.

This report illustrates its powerful clinical utility in the diagnosis and follow-up of suspected prosthetic valve infection.

Figure 2. Sagittal (A), axial (B), and coronal (C) SPECT image planes (Philips Skylight dual-head $\gamma$ camera) obtained 48 hours after intravenous injection of 150 mBq of Ga-67 citrate delineating a region (arrow) of pathologically increased uptake behind the sternum against a background of very little residual mediastinal blood pool activity. Note also that the sternum shows increased uptake, thought to represent normal postsurgical appearances. Bottom, On fusing the SPECT images with the original CT, the area of intense $^{67}\text{Ga}$-citrate activity is seen to correspond to the region of the aortic bioprosthesis, strongly suggestive in this clinical context of aortic valve prosthetic infection. Image planes as for the top row.

Figure 3. Follow-up $^{67}\text{Ga}$-SPECT/CT study after antibiotic treatment demonstrates resolution of the focus of abnormal uptake seen within the mediastinum on the previous study. Sagittal (A), axial (B), and coronal (C) SPECT image planes are shown. Bottom, Coregistered SPECT-CT images after treatment. Image planes are as above.
Disclosures

None.

References


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SUPPLEMENTAL MATERIAL

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**Video Legends**

Video clips for Figure 1A

**Movie I.** 2D Transesophageal echocardiography imaging of the prosthesis and left ventricle in long-axis (left panel) with colour flow mapping (right panel).

**Movie II.** Imaging of the aortic prosthesis in short-axis by transesophageal echocardiography.