Contamination of Transvenous Pacemaker Leads Due to Tunneled Hemodialysis Catheter Infection: A Report of 2 Cases

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Catheter-related bacteremia is a frequent complication associated with the use of tunneled hemodialysis catheters. Catheter-related bacteremia can lead to metastasis of infection to other sites. This article presents 2 patients with transvenous pacemakers (placed >2 years ago) who were receiving long-term hemodialysis therapy using tunneled hemodialysis catheters. Both were admitted to the hospital with catheter-related bacteremia. Blood cultures showed methicillin-resistant Staphylococcus aureus (MRSA) in both cases. Transesophageal echocardiography was negative for the presence of valvular endocarditis, but showed lead-associated vegetation in both cases. Intravenous antibiotic therapy was initiated, and both the tunneled hemodialysis catheters and cardiac devices were removed by a cardiothoracic surgeon. The catheter tip and leads cultures showed MRSA in both cases. After resolution of bacteremia, both patients received an epicardial cardiac device. Antibiotic therapy was continued for 6 weeks. Renal physicians providing dialysis therapy should be aware that catheter-related bacteremia could cause contamination of transvenous pacemaker leads. Because catheter-related bacteremia is a frequent complication, epicardial leads might be considered as an alternative route to provide cardiac support to catheter-consigned patients. Epicardial leads do not navigate through the central veins, lie in the path of blood flow, or cause central venous stenosis.


INDEX WORDS: Hemodialysis; pacemaker; tunneled dialysis catheter; catheter-related bacteremia.

Tunneled hemodialysis catheters can lead to the hematogenous spread of infection to distant sites, such as cardiac valves (endocarditis), vertebral column (discitis), or joints (septic arthritis).1 This report presents 2 cases of tunneled dialysis catheter–related bacteremia that showed contamination of the transvenous pacemaker leads of these patients.

Case 1
A 72-year-old long-term hemodialysis patient was admitted with fever, chills, and hypotension. His medical history included hypertension, diabetes, and left ventricular dysfunction. Surgical history was remarkable for multiple failed arteriovenous accesses, right internal jugular catheter (single body, step tip) insertion (6 months ago), and transvenous pacemaker and cardiac resynchronization therapy device placement 4 years previous. There have been no episodes of cardiac device–related infection. Physical examination of the catheter site showed warmth, tenderness, and minimal drainage through the exit site. The rest of the examination findings were unremarkable, including the pacemaker pocket site. The emergency department physician inserted a central catheter in the left internal jugular vein. After withdrawing blood culture specimens, intravenous antibiotics (vancomycin and cefazidime) and fluids were administered. The initial attempt at catheter removal by an interventionalist failed. Because the patient had a pacemaker, the interventionalist did not put excessive traction to pull the catheter out for fear that the catheter might be stuck to the cardiac device leads. A cardiothoracic surgeon was consulted, and computed tomography was performed that showed tethering of the catheter and leads to the vascular wall (Fig 1). This was considered to be the cause of the stuck catheter. The cardiothoracic surgeon documented lead involvement (vegetation) on transesophageal echocardiography (TEE) and removed the 2 devices simultaneously (Fig 2). The cardiac valves were free of vegetation. Both the catheter and pacemaker were removed. A laser sheath device (Spectranetics Corp, www.spectranetics.com) was used to remove the leads and catheter. Open thoracotomy was not required. The leads were found to be infected upon gross examination at the time of extraction. Temporary pacing was provided in the interim. Blood culture results were positive before catheter and lead removal. After resolution of fever at 24 hours, a new tunneled catheter was inserted. Bacteremia resolved at 48
hours, and a permanent subcutaneous epicardial system replaced the transvenous pacemaker at day 4 of admission. The catheter tip and leads showed methicillin-resistant *Staphylococcus aureus* (MRSA). The patient was treated for 6 weeks with vancomycin after each dialysis session. Although the patient has had 2 episodes of catheter-related infection, there has been no infection of the epicardial system during follow-up of 11 months.

Case 2

A 75-year-old Hispanic woman was admitted with fever and chills during hemodialysis therapy. She had been dialyzing with a right internal jugular Tesio hemodialysis twin catheter system (Medcomp, Harleysville, PA) that was placed 7 months ago. Her medical history included hypertension, coronary artery disease, and diabetes. Surgical history was remarkable for insertion of a transvenous pacemaker 2 years ago and multiple failed arteriovenous accesses. Physical examination of the catheter site showed warmth and tenderness without drainage through the exit sites. The rest of the examination findings were unremarkable, including the pacemaker site. After withdrawing blood culture specimens, intravenous vancomycin therapy was initiated. As in case 1, the initial attempt at catheter removal by an interventionalist failed, and a cardiothoracic surgeon was consulted. Computed tomography showed tethering of the catheter and leads to the vascular wall, which was considered to be the cause of the stuck catheter. The cardiothoracic surgeon documented lead involvement (vegetation) using TEE and removed the 2 devices simultaneously. The cardiac valves were free of vegetation. The leads and Tesio catheter were removed using the laser sheath device. As in case 1, the leads were found to be infected at the time of extraction. Temporary pacing was provided in the interim. Blood culture results were positive before catheter and lead removal. After resolution of fever at 12 hours, a new tunneled catheter was inserted. A subcutaneous epicardial system was placed on day 3 of admission after resolution of bacteremia (at 24 hours). The catheter tip and pacemaker leads were positive for MRSA. The patient was treated for 6 weeks with 1 g of vancomycin after each dialysis session. The patient has had 1 episode of tunneled dialysis catheter infection, and the epicardial system has been infection free for the past 18 months.

**DISCUSSION**

The present cases show that catheter-related bacteremia can lead to contamination of cardiac device leads. In general, the incidence of pacemaker infection ranges from 0.8%-5.7%. However, many reports have highlighted that patients with chronic kidney disease are at increased risk of infection. Although the incidence of pacemaker infection in hemodialysis patients has not been well studied, a recent case-control study (n = 152) by Bloom et al found that moderate to severe kidney disease (glomerular filtration rate $\leq 60 \text{ mL/min/1.73 m}^2$ [$\leq 1 \text{ mL/s/1.73 m}^2$]) was the most potent risk factor for infection of a pacemaker, with a prevalence of 42% in infected patients compared with 13% in the control group (odds ratio, 4.8).

Cardiac device infection can be a potentially life-threatening complication. Lead infection can occur alone or in association with the involvement of cardiac valves. Both are managed as endocarditis and require lead removal. Cardiac device lead infection can be confirmed if TEE shows lead vegetation. TEE can identify lead vegetation in 90%-96% of cases. Lead-associated endocarditis, a major contributor to high mortality, is not uncommon and has been known to occur in approximately 50% of patients presenting with device-related infection. *Staphylococcus* species continue to be a major culprit, causing 60% of cases of lead-induced endocarditis. In 1 study of lead-induced endocarditis caused by *staphylococci*, $>60\%$ were MRSA. The 2 patients presented in this report had MRSA. Fortunately, neither patient presented here had valvular vegetation or dysfunction.
Instead of navigating through the central veins and tricuspid valve, epicardial leads traverse through the subcutaneous tissue and are inserted into the epicardium. Transvenous leads can cause central venous stenosis by causing endothelial injury. The leads and fibrous tissue that cover them also can augment stenosis by occupying the available space in the central veins. Because catheter-related bacteremia is a frequent occurrence that imposes the risk of spread of infection to the transvenous leads, and on account of the previously mentioned factors, it is not unreasonable to consider epicardial leads as the preferred system in hemodialysis patients using tunneled hemodialysis catheters. These leads are not directly exposed to blood flow or the infected catheter and do not cause central venous stenosis. Some differences between the transvenous endocardial and subcutaneous epicardial leads are listed in Table 1.

In both cases, laser sheaths were used to remove the leads. It is worth mentioning that fibrotic tissue develops on the leads over time and binds the leads to the vascular wall and in the

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**Table 1.** Advantages and Disadvantages of Subcutaneous Epicardial and Transvenous Endocardial Cardiac Devices

<table>
<thead>
<tr>
<th>Subcutaneous Epicardial Cardiac Devices</th>
<th>Transvenous Endocardial Cardiac Devices</th>
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<tbody>
<tr>
<td>Central venous stenosis</td>
<td>Not observed</td>
</tr>
<tr>
<td>Infection</td>
<td>Uncommon&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Placement</td>
<td>Easily accomplished</td>
</tr>
<tr>
<td>Placed by</td>
<td>CT surgeon</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Very effective</td>
</tr>
<tr>
<td>Surgical complications</td>
<td>Minimal</td>
</tr>
<tr>
<td>Major vascular injury</td>
<td>Rare</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>General</td>
</tr>
<tr>
<td>Length of hospitalization (d)</td>
<td>1-2</td>
</tr>
<tr>
<td>Procedure setting</td>
<td>Inpatient</td>
</tr>
<tr>
<td>Preservation of central veins</td>
<td>Available</td>
</tr>
</tbody>
</table>

Abbreviation: CT, cardiothoracic.

Infection in a transvenous endocardial system ranges from 0.8%-5.6%. In contrast, 9 studies evaluating 253 epicardial leads failed to show a single episode of infection. To the best of our knowledge, no specific information exists in the literature regarding infection in long-term hemodialysis patients who harbor epicardial cardiac devices.
endocardium. Removal of these leads requires freeing the lead body from the fibrotic tissue. A variety of tools, including telescoping sheaths, have been used to remove cardiac leads. However, application of excessive force to detach the leads carries the risk of vascular or endocardial avulsion. In contrast, the laser sheath delivers the laser energy to the distal end of the sheath to release the lead. This technique offers a low complication rate, high success rate of complete lead removal, and efficient procedural time compared with nonlaser techniques.

In the present report, the catheter and leads were removed simultaneously because the leads were found to be infected using TEE. However, in the absence of lead involvement, the catheter should be removed first, antibiotic therapy should be continued, and the patient should be observed closely. The leads should be considered for removal if the patient remains bacteremic after catheter removal. The duration of antibiotic therapy with lead vegetation is the same as for endocarditis (ie, 6 weeks).

Catheter-related bacteremia can lead to contamination of transvenous pacemaker leads. The catheter and leads should be removed simultaneously if the leads are found to be infected (lead or cardiac valve vegetation). The epicardial route instead of a transvenous pacemaker might be a better option for such patients.

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REFERENCES


