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Case Report

Left Ventricular Assist Device 'Pocket' Infection: Alternative Treatment Strategy

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Abstract

A 31-year-old morbidly obese man (BMI > 75 kg/m^2) with end-stage heart failure was implanted with a Heartmate II LVAD (Abbott Laboratories, Abbott Park, IL, USA). He developed a Staphylococcus aureus pocket infection that was initially methicillin sensitive and converted to methicillin resistant. He was treated with surgical debridement and systemic antibiotics. Although initially controlled, he developed recurrence requiring additional surgical treatment and long-term antibiotic therapy, both systemic and topical (betadine-soaked sponges and VAC dressing). The purpose of this report is to describe the treatment strategy of this infected LVAD which resulted in complete healing with no further recurrence. The success of this approach—although unusual—allowed the patient to undergo successful gastric bypass surgery.

Introduction

The use of the implantable Left Ventricular Assist Device (LVAD) for end-stage heart failure has grown in popularity over the past several decades due to an ever-increasing number of advanced heart failure patients, expansion of the indications for its use, and improvements in the technology itself. However, with the larger LVAD population come the associated complications related to them, infection notwithstanding. Infection of the LVAD is a potentially life-threatening condition with limited options in treatment. Depending upon the degree and depth of the infection, the components of the LVAD involved, and the options in care, few pathways may be taken: LVAD removal, LVAD replacement, transplantation, or comfort care (i.e. hospice). The purpose of this report is to describe a case in which a young man with an infected LVAD was treated with an aggressive drainage and debridement together with systemic antibiotics and topical betadine dressing changes. Over the course of several months, most of which were outpatient, the LVAD infection remained controlled and the wound eventually healed with no evidence of recurrence on chronic antibiotic suppressive therapy.

Case Presentation

A 31-year-old morbidly obese man with a history of non-ischemic cardiomyopathy for four years was admitted for LVAD implantation. The intent was to support him for bariatric surgery consideration to make him eligible for future heart transplantation. As such he was designated as Destination Therapy, intravenous milrinone-dependent. His Body Mass Index (BMI) measured 75 kg/m^2. He was implanted with a Heartmate II LVAD (Abbott Laboratories, Abbott Park, IL, USA) without complication. Standard antibiotic coverage with cefazolin and vancomycin were give perioperatively. A preoperative nasal MRSA screen was negative. No postoperative complications occurred with discharge to a rehabilitation center on postoperative day 9. He remained at the rehabilitation center for a week and was discharged home accordingly with weekly outpatient clinic follow-up. Standard daily LVAD driveline dressing changes were conducted per protocol. He was readmitted seventeen days later with fever (39.5C) and chills as well as pain at the lower aspect of the sternotomy incision corresponding to the LVAD pocket. The driveline exit site did not appear to be involved. On examination there was drainage from the incision—serous non-foul-smelling fluid. A sample of the drainage was sent to microbiology. The WBC was 20.9 with a left shift. Blood cultures were drawn followed by administration of empiric antibiotics—Vancomycin and Cefepime. A CT scan of the chest and abdomen showed post-surgical changes in the chest and the suggestion of a fluid collection in the upper abdomen. The coumadin was discontinued, the INR reversed, and a heparin infusion initiated in preparation for surgical exploration (Figure 1). The LVAD pocket site was opened and a serosanguinous fluid collection was encountered—it was drained and cultured. The LVAD itself could be seen along with portions of the outflow graft and driveline. Copious irrigation with antibiotic solution was performed and a VAC dressing applied. The initial blood cultures, wound cultures, and operative cultures were all positive for methicillin-*sensitive* Staphylococcus aureus. Infectious Disease consultation was obtained and antibiotic recommendations made to switch to Cefazolin. A long-term IV catheter was placed and Cefazolin administration was continued through the hospital course. The wound VAC was changed every three days. The patient was discharged after three weeks with weekly outpatient follow-up in the Heart Failure/CT Surgical clinic. The blood cultures were no longer positive and the WBC normalized (Figure 2). He remained as an outpatient for three weeks until he developed recurrent fever (37.8 C) and chills. The WBC was 9.7 with no left shift, but rose with the next blood drawing. Blood and wound cultures were obtained and were positive for methicillin-*resistant* Staphylococcus aureus. The

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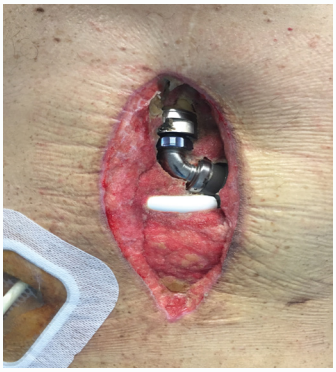

Figure 1: Exposed LVAD after wound exploration, debridement, and use of VAC dressing.

Figure 2: Progression of LVAD pocket wound healing—Note use of Betadine poured directly into site.

Infectious Disease service was re-consulted and IV Vancomycin was recommended. The INR was reversed, heparin instituted, and surgical re-exploration of the LVAD pocket site was undertaken. Operative findings demonstrated gross infection surrounding the LVAD. A more extensive debridement of the tissue surrounding the LVAD was performed exposing more of the LVAD itself with the driveline and proximal outflow graft until all gross infection was excised or at least exposed. The wound was copiously irrigated with antibiotic solution followed by application of full-strength betadine soaking the entire LVAD pocket. A VAC sponge was placed overtop the betadine-soaked pocket. The Betadine-VAC dressing was changed every three days as an inpatient along with the Vancomycin. The blood cultures remained positive daily for several days and then turned negative by the fifth day. They remained negative for the remainder of the hospital course (i.e. two weeks). A discussion with the patient, family, and healthcare providers to discuss future plans was initiated. In view of the inability to transplant and the inability to survive without the LVAD support, three options remained: LVAD replacement, palliative care/hospice, or current management with attempt at local control with the Betadine-VAC dressing and systemic antibiotics. The consensus was the last option. He was discharged on IV Vancomycin to complete a six-week course, then converted to oral doxycycline indefinitely. The LVAD pocket wound was covered with a Betadine-VAC dressing with home nursing every two days and weekly clinic follow-up. The patient's wound continued to heal well with reduction in the size of the VAC sponge. During the third month since discharge, the VAC was no longer needed and betadine soaked iodoform gauze was instituted. Finally, the wound completely healed with no further dressing required. The bariatric surgery service was consulted for consideration of weight reduction surgery. Approximately nine months following the LVAD placement, the patient was scheduled electively for a laparoscopic Roux-en-Y gastric bypass procedure. Careful consideration of the LVAD pocket and the driveline were discussed in order to avoid injury during placement of the trocars. Additional consideration of anticoagulation was discussed, converting oral (coumadin) to intravenous (heparin) forms (Figure 3). The procedure was completed without incident and the patient discharged in satisfactory condition. At present, the patient is doing well with no surgical complications.

Figure 3: Healed wound with patient in clinic for consideration of bariatric surgery.

Discussion

The use of implantable LVAD therapy for end-stage heart failure has become a standard of care for patients in need of mechanical support as a Bridge To Transplant (BTT) as well as those who are ineligible for transplant (i.e. Destination Therapy-- DT). There exist a population of patients whose endpoint is indeterminate at the time of LVAD implantation such that transplant eligibility may be achieved during support although the initial indication was DT. Whether BTT or DT, the LVAD is prone to infection since it is a foreign body attached to a skin-piercing driveline that is exposed to the external world and all the microbes associated with it. As such, either operative or acquired infection of the LVAD is not uncommon over time. Infection of the LVAD can be a relatively simple or complex, life-changing or life-threatening. A local driveline site infection, for example, may be managed with antibiotics and superficial wound care with no spread beyond the skin and soft tissue. An LVAD pocket infection and/or infection of the internal components of the LVAD (i.e. LVAD endocarditis) is another matter altogether, often fatal in nature. The options for the more complex forms of LVAD infection were examined by Bauer and others in a recent manuscript examining device exchange versus non exchange [1]. The conclusion from this systematic review and meta-analysis was that there was no advantage in overall mortality and infection recurrence with device exchange compared to non-exchange modalities. The non-exchange modalities reviewed in this study included the following: antibiotics alone, debridement, muscle or omental flap coverage of the infected LVAD, driveline relocation, and incision and drainage. The majority of the patients were treated with antibiotics alone (56.4%). The all-cause mortality for the exchange and non-exchange patients were 17.6% and 23.3% respectively at one year. The manuscript, however, does not discriminate the patients with regard to why one treatment was chosen over another and other details of infection and the surgeries to treat them—this information needs to be examined within the studies themselves.

As a general rule, surgical principles would dictate that infection of a foreign body requires its complete removal to achieve cure. However, this dictum has been challenged by the experience in the orthopedic and cardiovascular disciplines where certain conditions

make prosthesis preservation safer than removal [2,3]. In the cardiovascular literature, infected prostheses, such as prosthetic heart valves [4] and prosthetic grafts [5], have been salvaged—or at least controlled—without their removal. The same is true for the implantable LVAD. Several investigators have used a variety of techniques to treat infected LVADs including antibiotic beads [6] and tissue flaps [7,8] without the need to remove the infected device. The message from these investigators is the following: a systematic and multi-disciplinary approach is crucial (i.e. cardiac surgery, infectious disease, and other specialists including plastic surgery and heart failure cardiology); aggressive local and systemic treatment with frequent cultures to assess for changes in bacterial organism or resistance. These successful case reports in the orthopedic and cardiac surgical literature need to be viewed with a degree of caution since success is not always achieved. As indicated by Ernest and colleagues, topical adjuncts such as Betadine, Dakin's solution, or hydrogen peroxide do not always eliminate bacterial colony-forming-units [9]. In their in-vitro study of S. *aureus* biofilms on orthopedic implant materials including titanium, stainless steel, and cobalt chrome, while there were reduction in CFUs from all the agents, Betadine and hydrogen peroxide was superior to Dakin's solution. In our case report, removal of the infected LVAD was not an option since the patient was LVAD dependent, removal would have been technically disastrous in view of his body habitus, and transplantation was not an option. As such, an aggressive surgical approach together with systemic antibiotics controlled the infection with the possibility that it is eradicated. Although we considered tissue flap coverage, we assessed the wound weekly and found the patient's abundance of adjacent soft tissue to gradually cover the wound without surgical mobilization. During this time, betadine-soaking of the LVAD pocket was performed along with systemic antibiotics. In time, the wound completely healed allowing for bariatric surgical intervention. Details of the gastric bypass procedure is beyond the scope of this report except to comment on the importance of trocar/port placement to avoid damage to the LVAD and the driveline as well as the transition for oral to intravenous anticoagulation.

Conclusion

An aggressive surgical and antimicrobial strategy—both local and systemic—was successful in controlling, and possibly eradicating, an infected LVAD. Although representing a single case, consideration for others is suggested particularly when LVAD dependence is present and device exchange is hazardous.

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