

Pump Exchange from a Left Ventricular Assist Device to a Jarvik 2000 with a Postauricular Cable Due to Abdominal Driveline Infection

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ABSTRACT

Driveline infection in patients with implantable left ventricular assist devices (LVAD) remains common and crucial. Once a driveline exit-site infection reaches the LVAD component, radical treatment such as LVAD exchange may become necessary, although the clinical results are unsatisfactory. The Jarvik 2000 device, which utilizes a postauricular cable, allows the driveline to exit the body behind the ear (postauricular) instead of through an abdominal site. Here, we report the case of a patient who had awaited heart transplantation for more than 6 years and had a critical driveline infection that almost reached the LVAD pump. The patient underwent a pump exchange using the Jarvik 2000 with a postauricular cable, with excellent results. It is a useful replacement option for patients with abdominal driveline infections, owing to its small pump pocket and the availability of an alternative pathway for the driveline.

Key words destination therapy; driveline infection; Jarvik 2000 with postauricular cable; left ventricular assist device

Implantable left ventricular assist devices (LVAD) are increasingly used as a bridge to transplantation or destination therapy (DT) for patients with end-stage heart failure, and they significantly improve survival rates and quality of life.¹ However, abdominal driveline infection remains the most frequent complication in patients with LVAD, commonly contributing to a diminished quality of life. According to the Japanese Registry for Mechanically Assisted Circulatory Support, the abdominal driveline is the most common site of infection, with incidence rates of 27% and 42% at 1 and 2 years, respectively.² Once infections extend from the abdominal driveline exit site to the LVAD component, LVAD

exchange may become necessary for radical treatment. However, the prognosis of patients undergoing pump exchange for device infections remains unsatisfactory. The Jarvik 2000 with postauricular cable (PA Jarvik2000; Jarvik Heart, Inc., New York, NY) is an LVAD in which the driveline exits the body behind the ear instead of through an abdominal exit site.³ We herein report our experience with device exchange to PA Jarvik2000 for a difficult-to-cure driveline infection.

PATIENT REPORT

A 68-year-old male patient underwent DuraHeart implantation (Terumo Heart, Inc., Tokyo, Japan) at 62 years of age owing to end-stage heart failure caused by ischemic cardiomyopathy and has been awaiting heart transplantation. The DuraHeart is a magnetic levitation centrifugal pump with a driveline exit site in the abdomen. Following the procedure, the patient had an uncomplicated 5-year history of recovery. At 67 years of age, the patient developed his first driveline infection, which spread along the driveline from the exit site in the left abdomen to the lower umbilicus (Figs. 1a and b). The organism identified was *Klebsiella pneumoniae*, and the patient was administered clindamycin hydrochloride. Incisional drainage was performed, followed by negative pressure wound therapy (NPWT) using the VAC therapy system (KCI, San Antonio, TX) (Fig. 1c), and the infection went into remission (Fig. 1d).

Six months later, the infection recurred and spread along the driveline to the right upper abdomen (Figs. 2a and b). The patient underwent incisional drainage and NPWT, as in the previous case, and the infection went back into remission (Fig. 2c); however, it was feared that the infection would spread to the LVAD component in the next flare-up.

In Japan, patients over 60 years of age who are registered for heart transplantation are given a lower priority for transplantation than patients under 60 years of age. Therefore, it was anticipated that this patient may await heart transplantation for additional several years or would not receive a heart transplant. Thus, before a serious LVAD component infection could occur, we proposed replacing the device with the PA Jarvik2000,

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Abbreviations: DT, destination therapy; LVAD, left ventricular assist device; NPWT, negative pressure wound therapy; PA Jarvik2000, Jarvik 2000 with postauricular cable



Fig. 1. a: Pus discharge from driveline penetration. b: Abdominal CT shows an abscess extending to the lower umbilicus. White arrows indicate the spread of an abscess. c: Incisional drainage is performed, followed by negative pressure wound therapy. d: The wound goes into temporary remission.

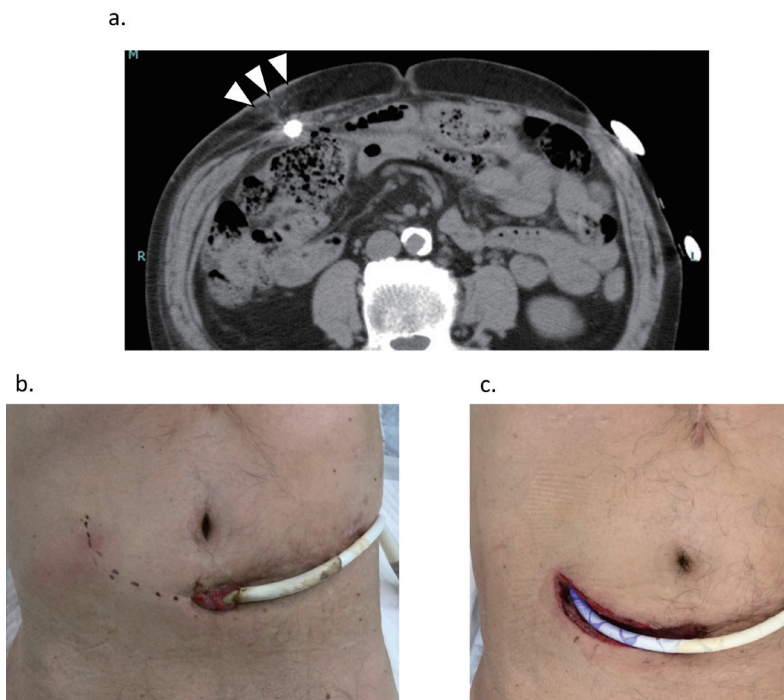


Fig. 2. a: Abdominal CT shows an abscess extending to the right upper abdomen. White arrows indicate the spread of an abscess. b: Redness is observed along the driveline to the right side of the abdomen. c: Temporary remission is achieved by incisional drainage and negative pressure wound therapy.

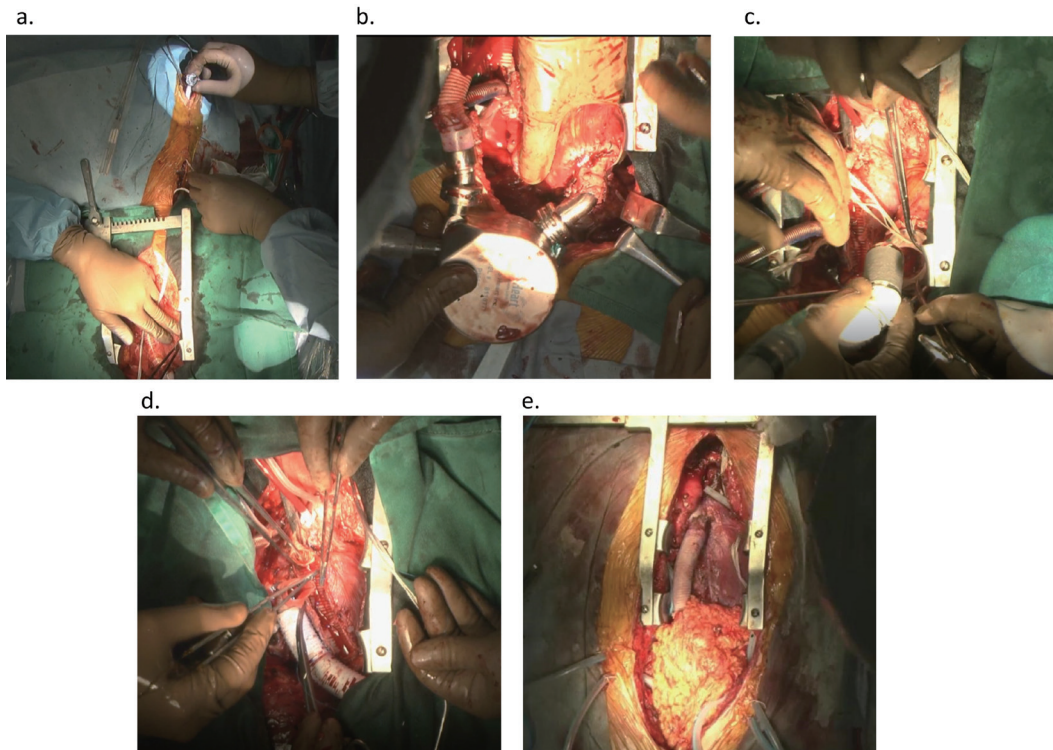


Fig. 3. Intraoperative findings. **a:** A subcutaneous tunnel is created from the pericardium to the postauricular region, and a pedestal cable is passed through it. **b:** The DuraHeart is removed. **c:** The Jarvik 2000 is inserted into the left ventricle. **d:** An outflow graft of DuraHeart is anastomosed with an outflow graft of Jarvik 2000. **e:** PA Jarvik2000 is covered with the greater omentum flap.

which has the advantage of a driveline that can be routed differently from that in the abdomen and has a smaller pump component. The patient and his family provided written informed consent for the procedure, and at age 68, he underwent a pump exchange with the PA Jarvik2000.

The implantation site of the pedestal was approximately 3 cm posterior and slightly above the ear, in the flat and thick part of the parietal bone, to avoid intracranial penetration. The patient was placed in a supine position, under general anesthesia, with his face turned toward the right. A median sternotomy was performed, and vertical skin incisions were made at the neck and scalp. After the cranial bone was exposed and the attachment site for the pedestal was determined, six holes were drilled using a template. We created a subcutaneous tunnel from the pericardium to the postauricular region and passed a pedestal cable through the tunnel (Fig. 3a). A pin connector was attached to the pedestal and secured with six screws. Once the pump was confirmed to be operating properly, the wound was closed using autologous pericardium.

After a cardiopulmonary bypass was established, the DuraHeart was removed (Fig. 3b), the inflow cuff

was sutured at the cardiac apex using 12 stitches (3–0 Ethibond with a felt mattress suture), and a Jarvik 2000 was inserted into the left ventricle (Fig. 3c). We anastomosed the outflow graft from the DuraHeart with the outflow graft from the Jarvik 2000 (5-0 Prolene) (Fig. 3d). The surgery was successfully completed after activating the Jarvik 2000 and coming off the cardiopulmonary bypass. Conversion to a PA Jarvik2000 covered with a greater omentum flap to prevent possible LVAD infection was successfully performed (Figs. 3e and 4a).

No intracranial hemorrhage observed on a postoperative CT scan (Fig. 4b). The patient's abdominal driveline passage healed completely (Fig. 5a), and he was discharged 5 weeks postoperatively. After discharge, he could bathe and shower daily without special precautions (Figs. 5b and c). Three years after the surgery, there were no issues with his daily quality of life and no signs of infection.

DISCUSSION

Infection remains one of the most common causes of morbidity and mortality, with most cases of infection occurring at the exit site of the driveline.⁴ In the case of DT without conversion to heart transplantation,

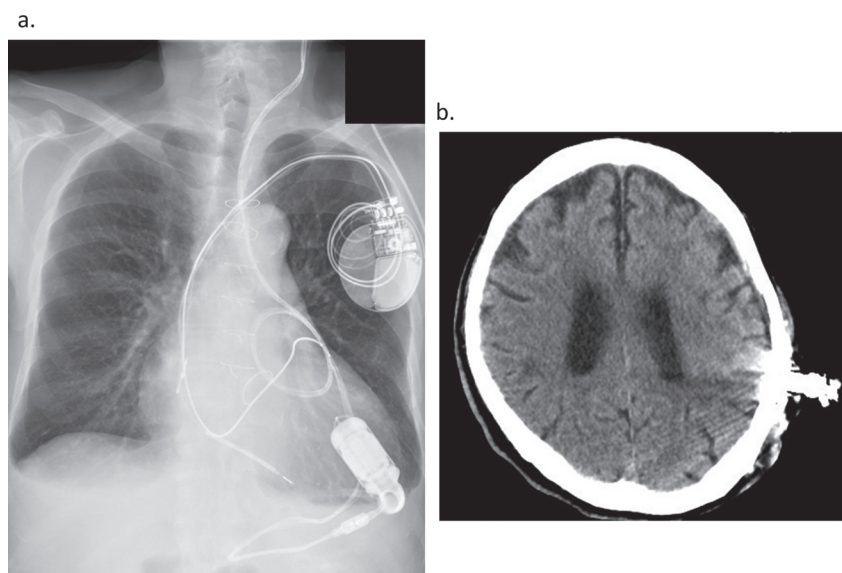


Fig. 4. a: Postoperative chest radiograph showing the PA Jarvik2000 pump connected to the left ventricular apex and the internal cable passing through the anterior aspect of the heart in a loop shape. b: The pedestal is attached to the parietal bone without cerebral complications.

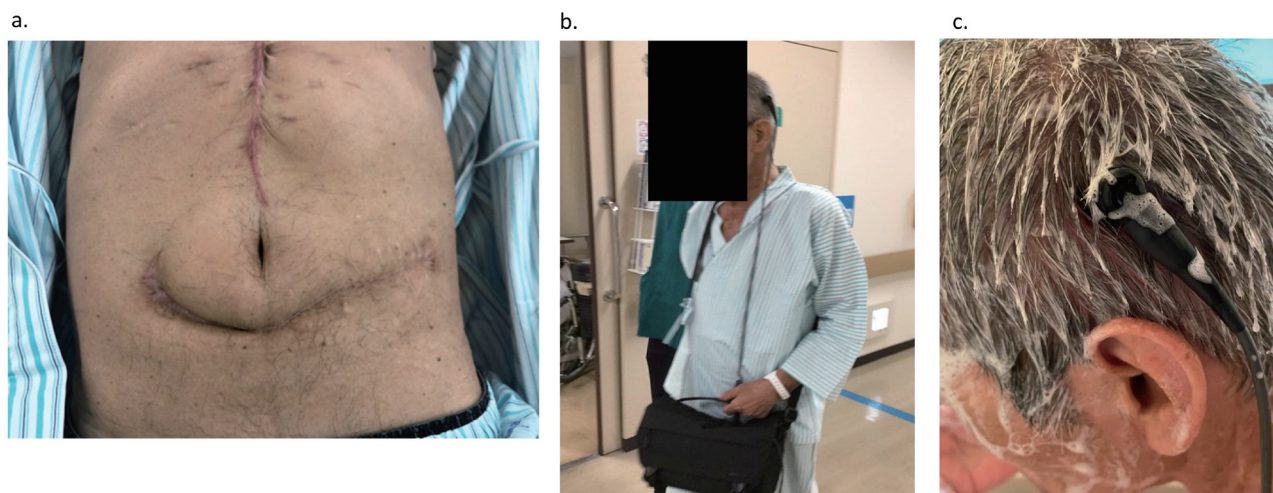


Fig. 5. a: An abdominal driveline passage is completely healed postoperatively. b, c: The patient performs daily activities, including showering, without special precautions.

infection is directly related to prognosis.⁵ In Japan, patients enrolled for heart transplantation at age 60 years or older, as in this case, are treated as if they underwent DT because of the extremely long waiting period required for heart transplantation.

The use of the PA Jarvik2000 was first reported by Westaby in 2002.⁶ This device is firmly attached to the stable skull bone; thus, stretching/movements of skin are avoided, which reduces the risk of delayed infection. In addition, the pedestal is placed sufficiently away

from the mediastinum and apex pump that the risk of device infection is low, even in the event of a local pedestal infection. Siegenthaler et al. reported that the PA Jarvik2000 device is associated with fewer device-associated infections (0.08 events/100 patient-days) than the HeartMate device. They also noted that driveline infections were treated with antibiotics and local wound care.⁷ Bejko et al. reported that, compared to the DL through the abdomen, a posterior auricular approach is associated with several benefits that improve the

patient's quality of life. These benefits include higher scalp skin resistance to infections, the absence of wound treatment, and the ability to shower. Thus, they found that the treatment was appropriate for long-term support.⁸ However, intracranial hemorrhage and damage to external components have been reported as complications specific to PA Jarvik2000 treatment.⁹

In the past, when LVAD exchange was performed for abdominal driveline infection, the driveline had to be passed through the abdomen even if a different route was used, and re-infection was a problem.¹⁰ With PA Jarvik2000, the risk of re-infection is expected to be low because the driveline can be placed via a completely different route. To the best of our knowledge, this is the first report of LVAD exchange to PA Jarvik2000 for an abdominal driveline infection, and the PA Jarvik2000 is expected to be useful in cases of abdominal driveline or pump pocket infection.

It is possible to continue NPWT and antimicrobials while waiting for transplantation in the event of a driveline or pump pocket infection. However, this option can be difficult to pursue for patients over 60 years of age who are registered for heart transplantation. The same is true for DT without conversion to transplantation. Here, we report the case of a patient with repeated driveline infections who could not be expected to undergo cardiac transplantation. Instead, the patient underwent pump exchange to PA Jarvik2000 with excellent results. In conclusion, the PA Jarvik2000 proved to be a useful replacement device for cases of abdominal driveline infection because of its small pump pocket and the ability to create a driveline pathway through a different route.

The authors declare no conflict of interest.

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