Modification of a Ventricular Assistance Device for a Hemiplegic Left Ventricular Assist Device Patient

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Neurologic events occur in up to 18% of patients with continuous-flow left ventricular assist devices (LVAD) and is associated with significant morbidity and mortality. The current form of the LVAD equipment is not suited to serve patients who are impaired by a stroke. By creating an assistance device for the LVAD equipment, we have been able to greatly improve the quality of life and self-dependence of a hemiplegic LVAD patient. *ASAIO Journal* 2019; 65:e12–e13.

Key Words: ventricular assist device, stroke, mechanical circulatory support, neurologic event

Since the Food and Drug Administration approval for left ventricular assist device (LVAD) as destination therapy, the neurologic event rate has increased significantly.[1] It can be hypothesized that this rise is because of the increasing age of the LVAD patients. These neurologic events are associated with significant morbidity and mortality.[1,2] Despite the risk for neurologic events, there is increase in the use of LVAD therapy. This emphasizes the need for adequate rehabilitation programs and innovative solutions for patients whom are impaired after a neurologic event. These patients often rely on professional healthcare or familial support for their daily practice and assistance with their device, which eventually leads to an increase in healthcare costs. We designed an unique additional equipment for the LVAD, which makes it possible for a hemiplegic patient to be able to operate his LVAD equipment and subsequently live independently in his own home.

Case Report

We present the case of a 29-year-old man on LVAD therapy who endured an ischemic infarct. He had to endure a stroke because of an embolus while on support with the Heartmate II LVAD system, resulting in right-sided hemiparesis. This proved to be a problem for the daily actions necessary to operate his LVAD equipment. To help this patient, we developed an assistance device in the medical engineering department of our hospital. The assistance device can be attached to the top of the Power Module with six suction cups and consists of a piece of PVC approximately 28 × 12 × 2 cm in which several slots have been milled (**Figure 1A**).

It works as follows:

1. To insert/remove the batteries in the clips, the patient puts the batteries upside down into the two slots on the left of the assistance device. Now he can attach or remove the clip with one hand (**Figure 1B**).
2. To connect the battery clip to the cable of the system controller, the clip with the battery is inserted horizontally into the slot on the right. The extra brace holds them down under the pivoting force during insertion of the cable into the clip. The cable can be released again in the same fashion (**Figure 1C**).
3. To be able to connect the system controller battery cables to the patient cable from the Power Module, an extra adapter is connected on top of the assistance device. This keeps the patients cable connector in place under pulling and pushing forces (*e.g.*, inserting and detaching the contra connector from the system controller) and under rotating forces (*e.g.*, tightening and untightening the locknut). An extra aluminum brace is attached to the front of the stud, the edge of this brace catches the rim of the connector to keep it in place when the patient detaches or connects the cables (**Figure 1D**).
4. The manufacturer of the Heartmate LVAD system supplies several solutions to carry the batteries and system controller. This patient preferred the Consolidated Bag, which has two slots for the batteries and an elastic pouch for the system controller. However, the patient was unable to insert the system controller in this tight-fitting pouch one handed. The solution was to remove the pouch and replace it with the belt attachment pouch as supplied in the Thoratec GoGear Wearable Accessories Kit. This pouch has been attached with 4 rivets to the inside of the Consolidated Bag (**Figure 1E**).

Finally, an approval was not required of the manufacturer because no changes were made that would impact the device intrinsically or its performance.

Discussion

The assistance device we developed is not presented here as a one size fits all model. It shows how one can make an assistance device to enhance independence of a hemiplegic LVAD patient. The rate of neurologic events remains disturbingly high in LVAD patients and is associated with high morbidity and mortality. Patients with a neurological event often require or are dependent on extended care and regular assistance with their LVAD. Because of the custom-made equipment, which

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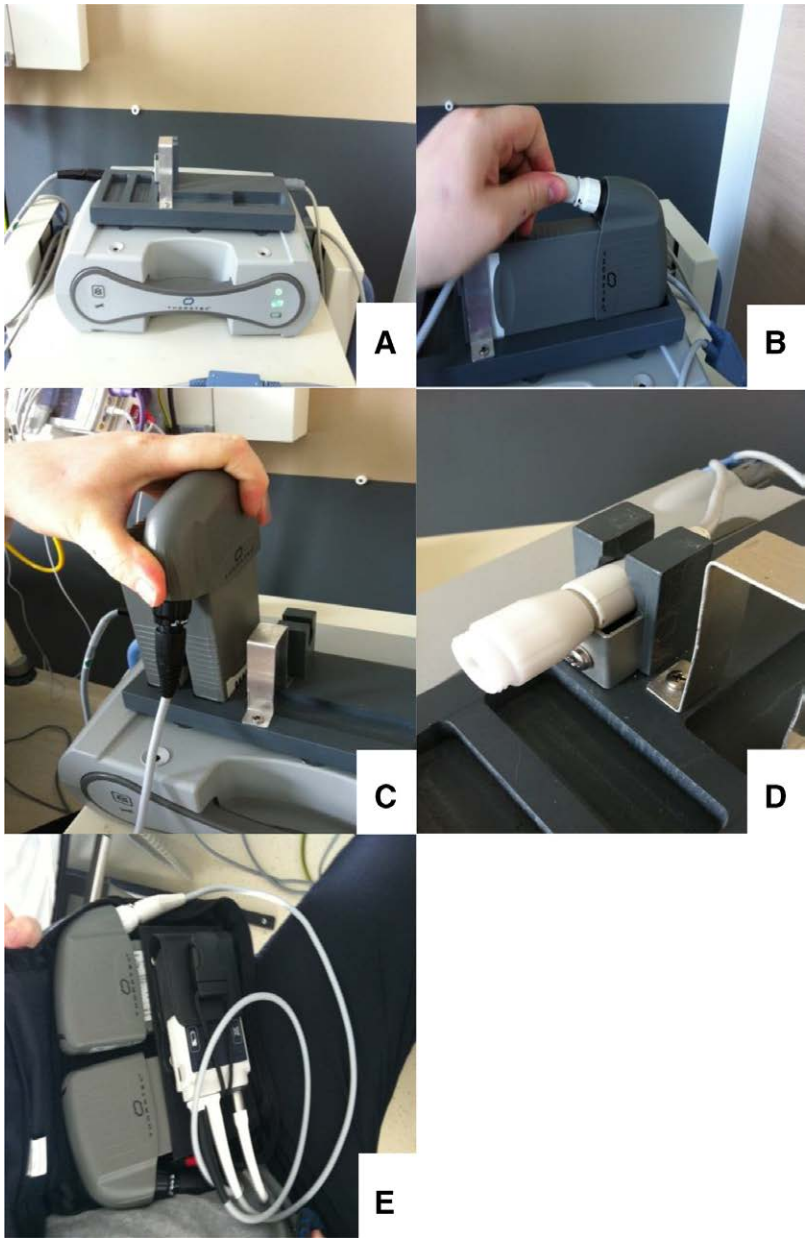

Figure 1. Assistance device for left ventricular assist device (LVAD) patients. **A**, The assistance device attached to the top of the Power Module with six suction cups. **B**, Inserting/removing the battery using the clips of the assistance device. **C**, Connecting/disconnecting the batteries to the system controller. **D**, Connecting/disconnecting the patients cable to the power module. **E**, Consolidated Bag customized using the Thoratex GoGear Wearable Accessories Kit. full color online

can be attached by suction cups to the power module, our patient is again mobile and self-reliant. He now can connect or disconnect the cables of the LVAD with one hand. It is important to realize that this LVAD patient, with his disabilities, now manages to live independently in his own home. Although this is the first patient who has received this modified LVAD equipment, we believe that LVAD patients all over the globe could benefit from these types of innovative additional equipment after the occurrence of an event. Our case study shows that it is possible to improve the quality of life of a hemiplegic patient with an LVAD using custom-made equipment.

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