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Case Report

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A Potentially Fatal Tissue Defect That Reveals the Cardiac Implantable Electronic Device

Kardiyak İmplante Edilebilir Elektronik Cihazı Açıkta Bırakan Potansiyel Olarak Ölümcül Doku Defekti

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ABSTRACT

In the treatment of end-stage heart failure, cardiac device implantation applications continue at an extremely rapid pace. As the applications increased, the complication rates also increased. These include its large size for pediatric patients and its impact on surrounding tissues due to compression, as well as systemic complications such as infection and bleeding.

This case is an 11-year-old male with a left thoracolateral tissue defect and device opening after left ventricular assist device implantation. In the treatment, a partial latissimus dorsi myocutaneous flap was performed and no postoperative complications were experienced. As the donors suitable for heart transplantation are generally adults all over the world, the patient has gained time for the transplant. We believe that this flap is easy and safe for this type of tissue defects. As device replacement can also be a mortal condition, the defect was immediately covered with a suitable tissue of sufficient thickness and vascularity.

Keywords: Cardiac implantable electronic device; exposition; tissue defect.

ÖZET

Son dönem kalp yetmezliğinin tedavisinde, kardiyak cihaz implantasyonu uygulamaları, son derece hız kazanarak devam etmektedir. Uygulamalar arttıkça, komplikasyon oranları da artmıştır. Gerek çocuk hastalar için ebat olarak büyük olması ve basıya bağlı çevre dokuları etkilemesi, gerekse enfeksiyon, kanama gibi sistemik komplikasyonlar bunlar arasında yeralmaktadır.

Bu olgumuz, sol ventriküler destek cihaz (LVAD) takılması sonrasında sol torakolateral doku defekti ve cihaz açıklığı oluşmuş 11 yaşında erkektir. Tedavisinde, kısmi latissimus dorsi (LD) miyokutaneus flebi yapılmış, postoperatif komplikasyon yaşanmamıştır. Tüm dünyada kalp nakli için uygun donörler, genelde erişkin olduğu için, hastanın nakile yönelik zaman kazanması sağlanmıştır. Bu flebin, bu tip doku defektlerinde kolay ve güvenilir olduğu kanısındayız. Cihaz değişimi de mortal bir durum olabildiği için defekt ivedi bir şekilde uygun, yeterli kalınlıkta ve vaskularitede bir doku ile örtülmesi sağlanmıştır.

Anahtar sözcükler: Kardiyak implante edilebilir elektronik cihaz; ekspozisyon; doku defekti.

Cardiac device implantation has become a popular choice of treatment and been recognized a time-saving method comparing to an open heart surgery; in addition, it was submitted that using these hardware in medicine is rapidly increasing in recent years.[1] Left ventricular assist devices (LVADs) are among these hardware and have become useful aids for the treatment of patients with end-stage heart failure. By the indications for the use of LVAD expanded, the total number of LVADs implanted each year and the total number of device-related compli-

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cations increased. Most of them are often device-related and can be listed as serious complications such as infections, bleeding, thrombosis, and device failure.[2] Infectious complications are common and particularly devastating as they may sometimes require device replacement, a risky and surgically hard procedure. It also is the main reason for readmission after discharge from the hospital.[3] During the antimicrobial approach is the principal treatment and often used as first choice in LVAD infections, complete eradication is almost difficult because of periprosthetic infections being able to colonize the pump pocket, internal equipment, and drivetrain by moving across the large surfaces of the device.[4] When the device infection is resistant to antibiotics, surgical intervention is required. This may include repositioning the equipment, soft tissue debridement, and even device removal. Nevertheless, if the device is seen exposed after debridement, the determined modality must be a well-vascularized healthy tissue coverage for the device, a flap.[5,6] In addition, under such conditions, a flap surgery guarantees the most suitable way to cover the cardiac hardware and take up surrounding area. Local flaps such as an advancement flap at fasciocutaneous levels are found to be very useful under the right surgical terms. Free and pediculed myocutaneous flaps, flaps combining with a skin graft, negative pressure wound therapies are considered to be good options. In this case report, we inform our experience of a patient with an exposed LVAD hardware and discuss using a partial latissimus dorsi (LD) myocutaneus flap for its coverage

Case Report

A growth-retarded (weighted between 22 kg), the 11-year-old, slim, male patient suffered from end-stage-heart failure due to dilated cardiomyopathy. His condition is a result of congenital heart defect called hypoplastic left heart syndrome. LVAD system had been implanted near the left ventricle to assist for systolic disfunction. A device pocket infection had developed after 2 months postoperatively. When he had been admitted to the city hospital from another health center located in the country, he had been presented with a large wound located on the left thorax, 4th costal trace, being 5 × 6 cm in size which had been substantially big (Fig. 1). In physical examination cardiac device's borders was visible to the naked eye and there was also a slow purulent flow coming from the wound. In addition, patient showed up with some severe systemic symptoms like malignant fever, nausea, sweating off, chills, a little bit confusion. Localized

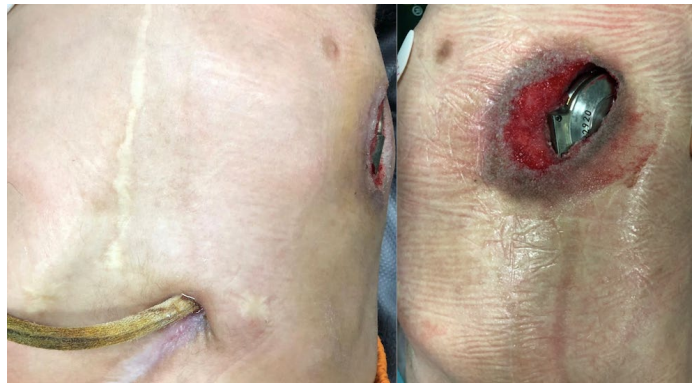

Figure 1. Front and side views of the tissue defect on the cardiac device, starting from the left head, in the preoperative period.

inflammatory signs were present (swelling, smelled purulent leak and pain, erythema, and skin ulceration.) A blood sample report showed increased amount of white blood cells (WBC), high sedimentation rate.

Surgical Technique

Before the reconstruction period we had patient aided by intravenous antibiotics according to the culture results, immediately had been taken from the open wound. After patient's symptoms were diminished (fever, chills, and sweating) and WBC count were returned their normal state (4.5–11.0×109/L) initially, first operation was performed with a total capsulectomy, keeping the device functions intact. Debridment of infected soft tissues primarily, irrigation of the device pouch with antibiotics laced saline was carried out secondly. When the defect on the thorax had worn due to a couple surgeries, a series of negative pressure wound therapy dressings were applied in order to keep the wound clean, stable, and for a plain soft tissue coverage.[7]

About 2 weeks after the first operation the planned myocutaneus flap surgery was performed. The patient was prepared in an open position with his left arm on top and also in the lateral lying status. Partial LD flap and its borders were identified for reconstructing the defect and to shroud the hardware using Doppler device. Intraoperative markings were prepared according to the defect size and by following a general fashion and the standard thoracotomy incision along the sixth rib that provides an excellent approach for harvesting was made throughout the anterior border of the LD muscle. We planned a sufficient skin island for muscle dissection in regard to preparing a partial musculocutaneous flap, also because it is a preferred, proven way for harvesting. The skin incision is extended through the fatty tissue down to the level of the dorsal fascia, further dissec-

tion is performed along the fascia, leaving it intact on the muscle, like reported before.[8] When the inferior part of the LD muscle was mobilized prior to the hemostasis, the harvesting concluded with a skin flap is in company with the fascia covering a dissected partial LD muscle (Fig. 2). By keeping the dissection plane strictly on the muscle's anterior surface to avoid injury to the vascular pedicle,[8] we preserved the pedicle which was originated from thoracodorsal vessels. With the rotation of elevated flap, a total coverage of the exposed device was finally provided (Fig. 3). A small amount of split-thickness skin graft were further used to cover up skinless part of the flap. Intravenous antibiotics were given to patient for 4 weeks after the surgery. Medical dressing were changed after the surgery in common sterilized way, daily in 1st week, and every 2 days prior to the 2nd week (Fig. 4). This lasted until a month had passed. By the way, the patient was monitored and his blood sample reports followed up closely. He had not shown any bad symptoms such as high fever, bleeding, and confusion. A computerized tomography was performed showing no trace of infection or fluid collection in the thorax, around the device. There were no wound infection, dissociation, or flap necrosis recorded over the course of the mean follow-up period which was lasted 3 months. Patient only complained about persistent itching, was uncomfortable with the right-sided lying position for a while.

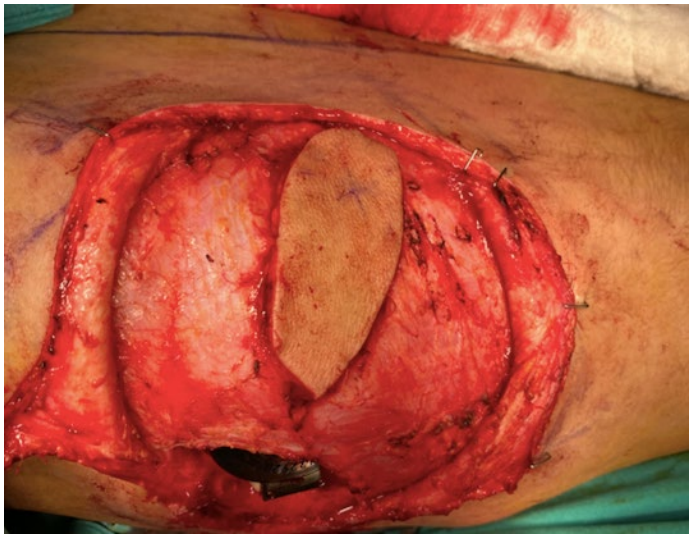

Figure 2. Revealing the Musculus latissimus dorsi in the lateral plane.

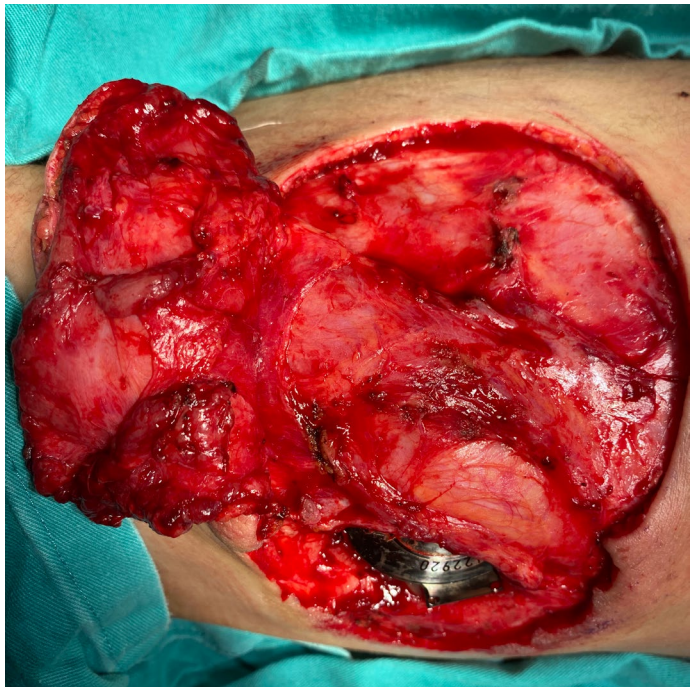

Figure 3. Rotation of Musculus latissimus dorsi over the defect by elevating it.

Discussion

As mentioned earlier usage of cardiac devices became more popular in medicine nowadays. Easing the complications dramatically, giving the patients a prolonged- stress-free life-

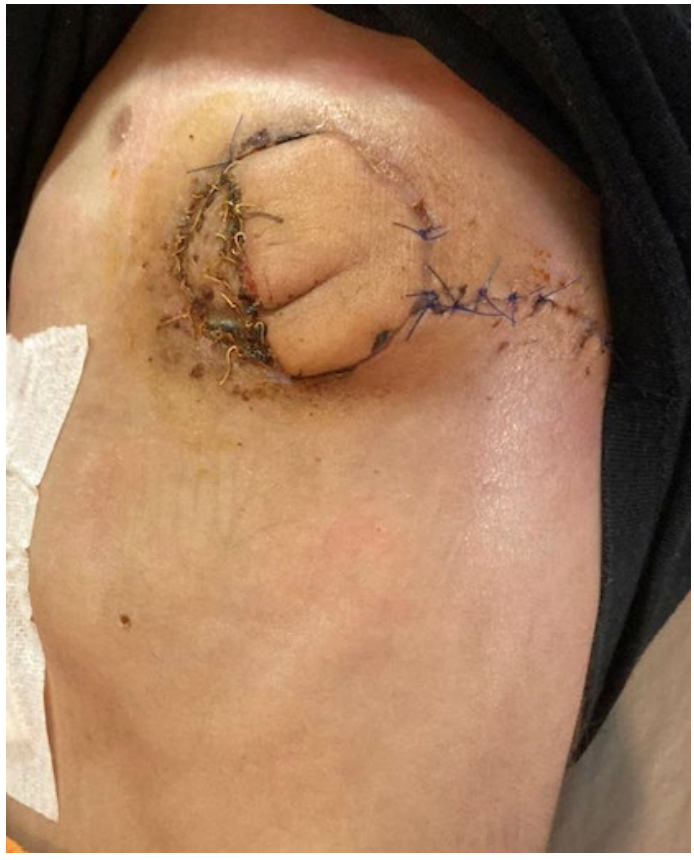

Figure 4. The view of the patient in the postoperative 1st week.

time, and letting out them from the transplantation line for a while are considered to be the main reasons. Unfortunately, this choice of treatment also has its disadvantages. Cardiac devices are generally implanted in subcutaneous or submuscular positions around the pectoral region that usually cause device infection, skin ulceration, device exposure with poor cosmetic appearance, and finally device damage which occurs with total increase rate of morbidity of cardiac patients.

Too many infectional cases have been reported in recent years, leading some awareness of the situation which begs a solution and research. It was shown that relatively high rates of device-related infection are likely related to the interface between colonized skin and hardware at the driveline exit site and surrounding poorly vascularized subcutaneous fat.[9] Most infections are due to opportunistic pathogens that spread over the capsule of the device rather than invade the device itself.[10,11]

While antibiotic therapy is the mainstay of treatment, It won't be able to eradicate infection fully. Wide debridement, negative pressure wound therapy/antibiotic bead therapy, and even device explantation may be necessary to clear the infection.[12] Furthermore, eradication of all pathogens can be the least of our worries, because surgical interventions largely results in an extensive defect around the device.[13] Hence, this points us toward the closure of open wound with using healthy vascular tissue, a flap surgery comes to mind. Soft tissue coverage with local flaps and driveline repositioning; superiorly pedicled rectus abdominis muscle (RAMC) flap, internal mammary artery perforator flap, and pedicled omental flaps[12,14] have been described useful if carefully executed. Free myocutaneous flaps, such as a LD myocutaneous flap or anterolateral thigh (ALT) flap, have also been reported as efficient choices for device coverage and control of infection.[15]

RAMC flap had never been an option in this case prior to the cardiac surgery that the patient have earlier. In order to implant the device in the superficial layer of the thorax for supporting the heart muscle, RAMC perforators had been put in a compromised situation. It would have been too risky to use it for coverage so we had no choice to select another option. ALT flap had been thought to be an alternative and reliable selection, but the patient being so slim and thin had restricted us from using it, because the muscle could have never provide a thick, dependable vascular tissue.

Local skin flaps are reported to being used continually, however instead of using the already insufficient local tissue, preferring a neighboring tissue like we did, in this case, will be a sane option. Partial LD myocutaneous flap as a first choice promises adequate soft tissue volume in especially thin patient like ours, a long pedicle and rotation arc for reaching out the open wound. In addition, designing the skin paddle based on Doppler-detected cutaneous perforators from the thoracodorsal artery may not be challenging due to lack of pulsations in patients with a continuous-flow LVAD system.[15]

Nevertheless, LD myocutaneous flap may require intraoperative – postoperative body re-positioning which can be an obstacle during the operation and also in follow-up period. This procedure took only one and half an hour; it started with creating a muscle cuff for covering the device to prevent infection, continued with shaping a partial, tension-free muscle flap as a new pouch with a durable skin graft and finally closing the skin smoothly , without extreme blood loss.

However, one of the main reasons to go for a cardiac device implantation in young patients, especially in children, is to save enough time for a proper heart transplantation surgery, so that patients can reach the adulthood. Since our patient is very young and skinny, and he is not going to be able to survive such a formidable operation; unless it could carry out, cardiac hardware implantation is being taken into consideration as an essential, and covering the device is a must.

Conclusion

We consider that the described approach is trustworthy, practical, and efficient. We believe this surgical notion may reduce long-time wound care cost. Furthermore, as much as our results are likely and agreeable we do not parallel our result to the other various, innovative methods for cardiac device coverage.

Disclosures

Informed consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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