SERBIAN ARCHIVES OF MEDICINE Est.1872

Address: 1 Kraljice Natalije Street, 11000 Belgrade, Serbia
☏ +381 11 4092 776, Fax: +381 11 3348 653
E-mail: office@srpskiarhiv.rs, Web address: www.srpskiarhiv.rs

Paper Accepted* **ISSN Online 2406-0895**

Case Report / Приказ случаја

Svetozar Putnik[1,2,†], Duško Terzić[2], Emilija Nestorović[2], Dejan Marković[1,3], Miljko Ristić[1,2]

Successful surgical treatment of terminal heart failure in the adolescent – left ventricular assist device implantation and subsequent heart transplantation

Успешан хируршко лечење терминалне срчане инсуфицијенције код адолесцента: Имплантација уређаја за механичку потпору циркулације леве коморе и касније трансплантација срца

[1] School of Medicine, University of Belgrade, Belgrade, Serbia;
[2] Clinic for cardiac surgery, Clinical Center of Serbia, Belgrade,Serbia;
[3] Center for Anesthesiology and Reanimation, Clinical Center of Serbia, Belgrade,Serbia

Received: February 23, 2017
Revised: July 21, 2017
Accepted: July 24, 2017
Online First: August 4, 2017
DOI: https://doi.org/10.2298/SARH170223155P

† **Correspondence to:**
Svetozar PUTNIK
Clinic for cardiac surgery, Clinical Center of Serbia, 8 Dr. KosteTodorovića Street, 11000 Beograd, Serbia
E-mail: **svetozar073@yahoo.com**

Successful surgical treatment of terminal heart failure in the adolescent – left ventricular assist device implantation and subsequent heart transplantation

Успешан хируршко лечење терминалне срчане инсуфицијенције код адолесцента: Имплантација уређаја за механичку потпору циркулације леве коморе и каснија трансплантација срца

SUMMARY

Introduction Implantation of the new generation left ventricular assist device (LVAD) is an efficient therapeutic option as a bridge to transplantation in adults, as well as in children and adolescents with small body surface.

The aim of this work was to present the case of a successful surgical treatment of terminal heart failure in male adolescent who had LVAD implanted as a bridge to heart transplantation.

Case Report The patient, 17-year old male, was admitted with the end stage of heart failure due to the dilated cardiomyopathy and implanted LVAD. Fourteen months after LVAD implantation a sucessful „second stage" surgical procedure was performed an ortotopic heart transplantation preceded by the LVAD explantation.

Conclusion Long therm mechanical circulatory support is an effective and safe method in treatment of the end stage heart failure as a bridge to transplantation in the adolescent period.

Keywords: heart failure; heart transplant; left ventricular assist device; adolescents

САЖЕТАК

Увод Имплантација уређаја за механичку потпору циркулације леве коморе (УПЛК) нових генерација је ефикасна терапијска опција као мост до трансплантације код одраслих, али и код деце и адолесцената са мањом телесном површином.

Циљ рада је био презентација хируршког лечења терминалне срчане слабости код мушког адолесцента коме је имплантиран УПЛК као „мост" до касније успешне трансплантације срца.

Приказ болесника Пацијент је хоспитализован на у терминалном стадијуму срчане инсуфицијенције на бази дилатативане кардиомиопатије. Четрнаест месеци касније, након појаве адекватног донора, извршена је експлантација уређаја заједно са болесним срцем примаоца и успешна трансплантација срца.

Закључак Уређаји за трајну механичку потпору циркулације су ефикасна терапијска опција у третману терминалне срчане инсуфицијенције као „мост" до трансплантације срца.

Кључне речи: срчана слабост; трансплантација срца; уређаји за потпору леве коморе, адолесценти;

INTRODUCTION

The first adult human heart transplant was performed by Christian Barnard in 1967. In 1966 Michael DeBakey implanted an left ventricular assist device (LVAD) for the first time. As the number of donors continue to decrease the raised demand in long therm circulatory support is registered. Implantable mechanical circulatory devices, such as left ventricular assist device, have emerged as a standard option to improve survival and quality of life of patients with end-stage heart failure. The indications for LVAD implantation include bridge to transplantation, bridge to recovery and destination therapy. As technology advances, limitations due to age, body size, and comorbidities are becoming less prohibitive. Implantation of the last generation of LVAD became the standardt therapeutic option for bridge to transplantation in adults, as well as for children and adolescents with lower body surface.

We present the case report of a successful surgical treatment of terminal heart failure in male adolescent who had LVAD implanted as a bridge to heart transplantation.

CASE REPORT

A 17 years old patient with the end stage heart failure was admitted to Clinic for cardiac surgery ,Clinical Center of Serbia with the indication for the long therm mechanical circulatory support device implantation as a bridge to transplantation.

Prior to the admission the patient was hospitalized due to several episodes of cardiac decompensation. The echocardiographic findings show the left ventricle severely dilated (EDD 7.0cm/ESD 6.6cm), globally hypocontractile, with reduced overall systolic function ejection fraction (EF) by Simpson 15%. The right ventricle was dilated (3.5 cm). Billateral pleural effusion was marked, as well as the presence of fluid in the peritoneal cavity.Body surface area was 1,44 m^2.Patient was categorized as NIHA Class IV, INTERMACS Class 2.

The surgery was performed in general anestehsia through median sternotomy, with the use of extracorporeal circulation (CPB), on beating heart without the need of aortic cross clamping. After the instituon of CPB the inflow cannula site was marked in the apex of the left ventricle using the echocardiographical guidance. The inflow cannula sited was reinforced with pladgeted sutures.After the inflow cannula implantation the otflow graft was anastomozed to the aorta following by the driveline was tunelled the skin in the upper right quadrant of the abdomen. The pump speed gradually increased with the weaning from the CPB.

The postoperative course was uneventfull. Laboratory and radiological analysis were within the reference values (Figure1).

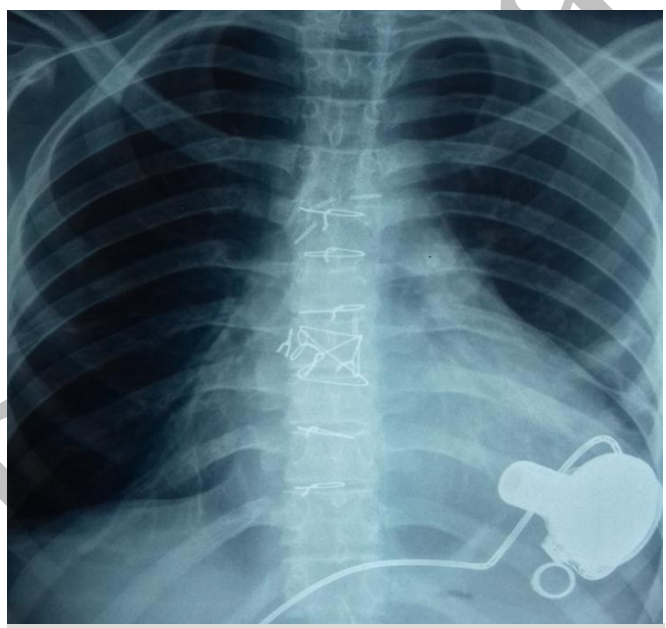

Figure 1. Radiografic finding after LVAD implantation.

The echocardiography at discharge showed the left ventricle size decrease, (EDD 6.7, ESD 6.1 cm). The right ventricle size was 1.6 cm with satisfactory systolic function.The inflow cannula had the good flow rate of 1.65 m/s.

The patient was discharged, hemodynamically stable, in good general condition.The skin around drive line exit site healed well, with no signs of infection.

In the follow up period the patient was on a regime of regular clinical follow-up on the heart transplantation waiting list. INR was controlled regularly, as well as the pump parameters as well as the driveline exit site. All the diagnostic procedures necessary for heart transplantation were done in the follow up period. Control CT scan showed that the inflow and outflow cannulas were competent with no signs of thrombosis (Figure 2).

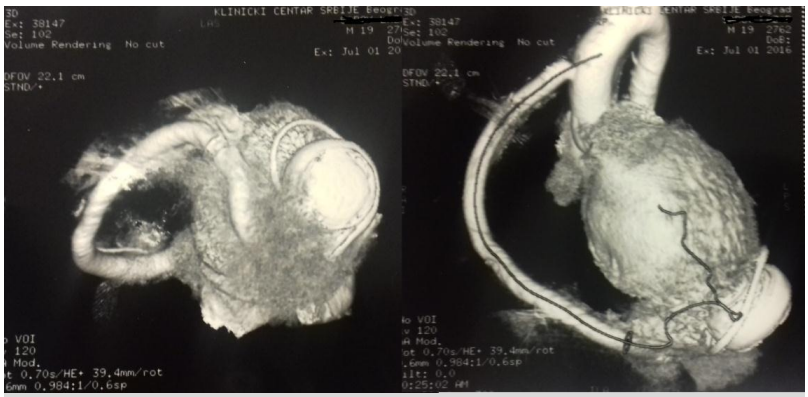

Figure 2. MSCT finding- outflow cannula with the aorta and the inflow cannula with the left ventricle were competent.

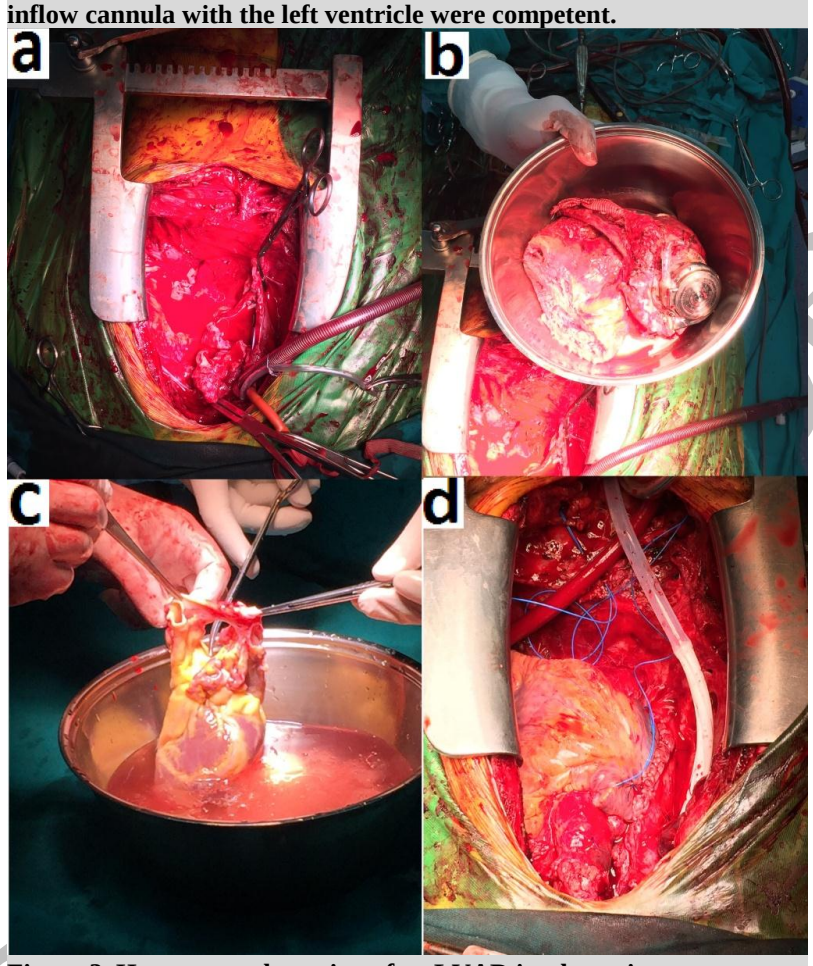

Figure 3. Heart transplantation after LVAD implantation.
a, b - empty pericard cavity after explantationHVAD and recipients heart; c - preparation of donor heart; d - transplanted heart.

Fourteen months after installing the HearWare LVAD, the heart transplantation was performed. Following the resternotomy and the institution of CPB explantation of the recepient's heart and the LVAD was perfomed. We used standard aortic cannulation and the bicaval venous cannulation. The donor heart implantation was done using the biatrial tecnhique (Figure 3).

The immediate postoperative course was uneventfull with no rejection elements found on the regular heart biopsies and the satisfactory echocardiographic findings.

The patient was discharged after a month, hemodynamically stable, in good general condition, with adequate cardiac and immunosuppressive therapy. After one year follow up patient is alive and well with no signs of the humoral rejection and satisfactory control echocardiography.

DISCUSSION

The prevalence of the advanced heart failure is increasing worldvide. Despite the limited availability of donor hearts cardiac transplantationis remains the gold standard for the treatment of terminal heart failure. One of the most promising new alternatives to heart transplantation is use of ventricular assist devices [1].

The number of LVAD systems implanted worldwide has increased due to significant improvement in survival rates in recent years. There are several factors that have contributed to these improved results. The systems are easier to implant than their forerunners, they are more durable and relatively easy to replace in the case of emergency, while the postoperative anticoagulation can be less intensive [2].

The Heart Ware Ventricular Assist System is a small size, implantable centrifugal continuous-flow blood pump. It utilizes a hybrid magnetic/hydrodynamic impeller suspension for novel frictionless rotation, and optimizes flow, pump surface washing, and hemocompatibility. The HeartWare pump is connected to light weight patient peripherals (controller, batteries) by a thin, flexible driveline with fatigueresistant cables. In comparison with contemporary marketed VAD pumps, the HVAD has an integrated inflow cannula, allowing implantation within the pericardial space, and requires no abdominal surgery for formation of a pump pocket. The pump controller permits accurate flow estimation and maintains log files to enable flow and power waveform analyses [3].

Different devices for long therm mechanical support of circulation are in use in our department (Heart Mate 2, Heart Mate 3, Excor Berlin Heart, HeartWare). The Heart Mate 2 device is an axial pump that requires making of a tissue pocket and larger body surface of the patient while the Heart Mate 3 is a centrifugal pump of significantly larger dimensions than the Heart Ware.The Excor Berlin Heart is a pulsatile, pneumatically controlled external device that provides biventricular support . The HEART team made the decision to implant the Heart Ware device with regards to the limited body surface of the patient and the fact that the patient's right ventricular function was acceptable at the moment of implantation.

Implantation of LVAD was previously restricted to patients with a body surface area of 1.5 m2, and those are primarily children and adolescents, but the continuous flow LVAD have been proven as safe in patients as low as 1.3 m2. The Heartware LVAD, which is implanted intrapericardially, practically does not have body size limitations. This is in contrast to heart transplantation where most programs limit donors to 15% of the weight of the recipient [4].

Adolescents with heart failure can be successfully supported on a long-term basis with the LVAD as a bridge to transplantation [5].

This case represents the successful use of LVAD as a bridge to transplantation in an adolescent patient with smalle body surface. The LVAD improved patient’s end organ function and symptoms, leading to rehabilitation and weight gain that made him a more suitable heart transplant candidate.

The presented case of an adolescent with smaller body surface has shown that the implantation of devices for long therm mechanical circulatory support of the last generation is a contemporary effective and safe therapeutic option in the treatment of terminal stage heart failure. Although technically challenging due to extensive adhesions and the proximity of the right ventricle to sternum,

the subsequent heart transplantation has been performed successfully with the uneventfull recovery of the patient.

REFERENCES

1. Miller LW, GuglinM. Patient selection for ventricular assist devices: a moving target. J Am Coll Cardiol. 2013; 61: 1209–21.
2. Krabatsch T, Potapov E, Soltani S. Should LVAD implantation be the new gold standard for terminal heart disease? Herz. 2015; 40: 231.
3. Slaughter MS, Pagani FD, Rogers JG. HeartMate II Clinical Investigators. Clinical management of continuous-flow left ventricular assist devices in advanced heart failure. J Heart Lung Transplant. 2010; 29: S1–S39.
4. Slaughter MS, Rogers JG, Milano CA. Advanced heart failure treated with continuous-flow left ventricular assist device. N Engl J Med. 2009; 361: 2241–51.
5. Helman DN, Addonizio LJ, Marales DLS Catanese KA, Flannery MA, Quagebeur JM, Edwards NM, et al. Implantable LVAD can successfully bridge adolescent patients to transplant. J Heart Lung Transplant. 2000; 19: 121–6.

