POLISH HEART JOURNAL

Kardiologia Polska
The Official Peer-reviewed Journa
of the Polish Cardiac Societ
since 195

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ISSN 0022–9032 e-ISSN 1897–427

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Authors: Monika Budnik, Małgorzata Sobieszczańska-Małek, Radosław Wilimski, Karolina Żbikowska, Katarzyna Błońska, Grażyna Popko, Zuzanna Strząska-Kliś, Jakub Kościołek, Katarzyna Kodziszewska, Mariusz Kuśmierczyk

Article type: Clinical vignette

Received: January 23, 2025

Accepted: February 20, 2025

Early publication date: March 17, 2025

Echocardiography in a patient with Aeson Total Artificial Heart: First implantation in Poland

Short title: Echocardiography in a patient with Aeson Total Artificial Heart

Monika Budnik[1], Małgorzata Sobieszczańska-Małek[2], Radosław Wilimski[2], Karolina Żbikowska[2], Katarzyna Błońska[2], Grażyna Popko[2], Zuzanna Strząska-Kliś[2], Jakub Kościołek[2], Katarzyna Kodziszewska[2], Mariusz Kuśmierczyk[2]

[1]1 st Chair and Department of Cardiology, Medical University of Warsaw, Warszawa, Poland
[2]Department of Cardiothoracic Surgery and Transplantology, Medical University of Warsaw, Warszawa, Poland

Correspondence to:
Monika Budnik, MD, PhD,
1st Chair and Department of Cardiology,
Medical University of Warsaw,
Banacha 1a, 02–097 Warszawa, Poland,
e-mail: moni.budnik@gmail.com

We present the first implantation of Aeson Total Artificial Heart in Poland as a bridge therapy to heart transplantation in a 37-year-old man with dilated cardiomyopathy, end-stage biventricular heart failure, requiring circulatory support *via* extracorporeal membrane oxygenation. The patient was disqualified from the procedure of implantation of left ventricular assist device due to severe right ventricular dysfunction.

An implantable component, the Aeson prosthesis mimics the function of a natural heart and is powered by the electrohydraulic motor pump unit (comprised of a primary and auxiliary motor). The prosthesis has a shape similar to the human heart, replaces the left and right ventricles of the heart and works as a pump ensuring blood circulation in the body [1]. Each cavity is separated into two parts by a soft, flexible membrane; one covered with ePTFE and in contact with the blood, called the chamber, and the other in contact with the actuating fluid, called the “compliance chamber” (Figure 1A).

The electrohydraulic motor pump unit mobilizes the silicon oil, which moves the membrane to reproduce the viscoelastic movement profile of cardiac muscle. The system regulates blood flow through the pump by responding to changes in preload, which is measured by a system of built-in sensors [2].

In the initial transesophageal echocardiography in the operating room, we excluded the presence of patent foramen ovale and thrombi in the heart chambers.

Cardiac surgeons performed artificial heart implantation consisting of ventriculectomy, closing the coronary sinus, closing the left atrial appendage, atrial anastomosis with implantation "mitral" and "tricuspid" atrial flanges, positioning of the atrial interface and positioning and locking the prosthesis, performing anastomoses of the pulmonary trunk and aorta with vascular grafts, as well as tunneling the driveline.

During purging the prosthesis and CPB weaning Aeson was started. Transesophageal echocardiography was performed to check at first the presence of residual air in the left atrium, the left ventricle, aorta and pulmonary veins.

After completing removal of the aortic cross clamp, we could carefully observe the cardiac cycle in transesophageal echocardiography. We were able to identify the native right and left atria and both "artificial ventricles" divided into a proper part and a "compliance chamber" separated by a membrane. We observed the "contraction" of the heart as the inward deflection of the membrane, causing blood to be pumped into the aorta, and the outward deflection of the membrane, causing diastole of the ventricle, during which the ventricle is filled with blood (Figure 1B–D; Supplementary material, *Videos S1* and *S2*). The contraction of both atria did not differ from the analogous contraction in the native heart. Moreover, the movement of the implanted artificial atrioventricular and arterial valves was similar to the native valves.

The system basically makes it impossible to perform transthoracic echocardiography, except for the assessment of the inferior vena cava and right atrium. During implantation evaluation using transesophageal echocardiography is necessary.

The patient was extubated 12 hours after the surgery, he was breathing spontaneous and was in full logical contact.

We are convinced that a new era has opened in global and Polish transplantology and echocardiographic examinations in this group of patients will be particular challenges [3].

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/polish_heart_journal.

Article information

Conflict of interest: None declared.

Funding: None.

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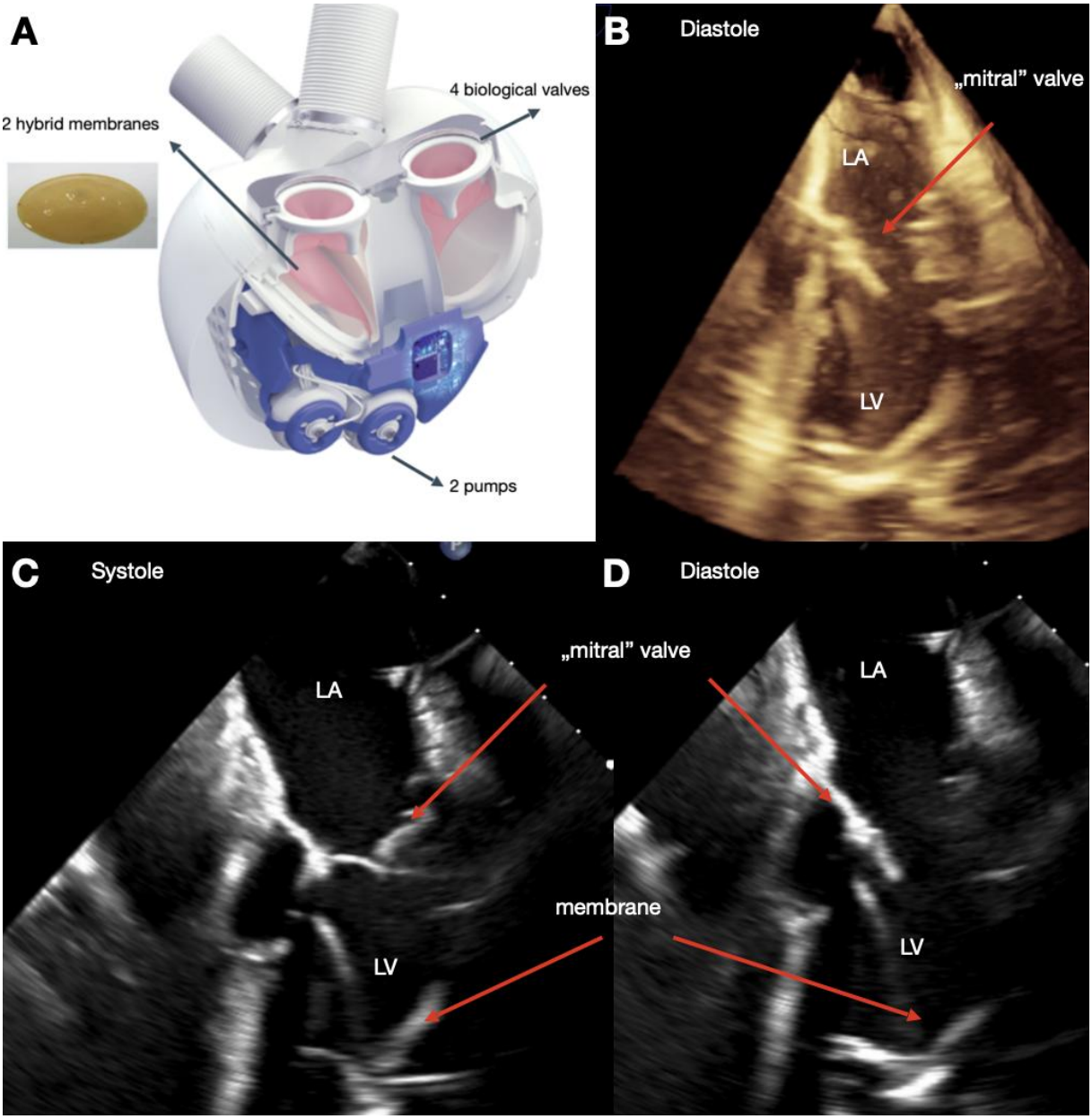

Figure 1.

Abbreviations: LA, left atrium; LV, left ventricle