

First Implantation of a Continuous Flow Left Ventricular Assist Device in Iraq: Paving the Way for Heart Transplantation

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Abstract

The first successful implantation of the HeartMate 3 LVAD in Iraq represents a transformative achievement in the nation's medical history. Conducted collaboratively by German and Iraqi teams in December 2023, the procedure addressed end-stage heart failure in a 60-year-old male. Despite significant healthcare challenges, the patient achieved excellent outcomes, transitioning from NYHA IV to functional class I within a year. This milestone establishes Iraq's capacity for advanced cardiac care and paves the way for future heart transplantation programs. Sustained international collaboration and investments in healthcare infrastructure are essential to ensure the expansion of such life-saving innovations in the region.

Keywords: migraine; vagus nerve stimulation; occipital nerve stimulation; neuromodulation; headache; nerve stimulation

Introduction

Heart failure remains a leading cause of morbidity and mortality worldwide, presenting significant healthcare challenges, especially in regions with limited access to advanced medical technologies (1-2). In Iraq, the burden of heart failure is compounded by ongoing healthcare infrastructure challenges and the limited availability of cutting-edge treatments. This scenario underscores the critical need for innovative solutions that can enhance patient outcomes and pave the way for more complex cardiac interventions, such as heart transplantation (3).

Iraq, a fast-growing country with a promising future, is witnessing burgeoning interest and development in the medical field. This growth fosters an environment ripe for the introduction of advanced medical technologies and procedures crucial for elevating patient care and health outcomes across the nation.

The introduction of Left Ventricular Assist Devices (LVAD) has revolutionized the treatment landscape for end-stage heart failure by providing a viable alternative to heart transplantation. VADs offer bridging solutions for patients awaiting donor hearts or serving as a destination therapy (4). Among these, the HeartMate 3 has distinguished itself with its advanced technology and improved patient outcomes after

its first implantation worldwide by Prof. Schmitto and his team at Hannover medical school (MHH), Hannover, Germany in 2014 (5). This device utilizes a magnetically levitated centrifugal flow pump designed to reduce complications and improve survival rates without the constraints of mechanical bearings (6-7).

This case report discusses the first implementation of the HeartMate 3 LVAD in Iraq and one year follow up, performed on December 2023, at Nasiriyah Heart Center in Dhi Qar. This successful milestone marks a significant advancement in the country's medical history and represents a breakthrough in the management of severe heart failure for Iraqi patients, establishing a foundational step towards heart transplantation programs within the country.

The Institutional Review Board (IRB) or equivalent ethics committee of Hannover Medical School did not approve this study, as case reports do not require approval under the university's policy. The Patient provided informed written consent for the publication of the study data.

During the preparation of this work, we used Gemini to improve the language. After using this tool, we reviewed and edited the content as needed and take full responsibility for the final content of the publication.

Case Presentation

Patient Background: A 60-year-old male with a history of severe dilated cardiomyopathy presented with a LVEF of approximately 20%. The patient had a recent history of multiple hospital admissions due to worsening heart failure symptoms despite receiving guideline- directed medical therapy. The patient was classified NYHA IV as well as of INTERMACS 3 according to the Interagency Registry for Mechanically Assisted Circulatory Support

Preoperative Evaluation: The patient's mean arterial blood pressure was 60-70 mm Hg, and the cardiac index was 1.8 liters/min/m². Comprehensive preoperative evaluation included echocardiography, right heart catheterization, laboratory tests, clinical evaluation and assessment of risk scores for the surgical procedure.

Procedure: The operation was a testament to international collaboration, jointly performed by Prof.Dr. J.D.Schmitto and Dr. med. Ali Saad Merzah representing the German team, who guided and mentored the Iraqi team, including Dr. Aqeel Alkahfaji and Dr. Salwan Qahtan. This fusion of expertise and knowledge transfer not only ensured the success of the procedure but also laid a strong foundation for the advancement of cardiac care in Iraq.

The patient provided informed consent. Median sternotomy was performed, followed by partial opening of the pericardium to protect right heart function while allowing access for cardiopulmonary bypass cannulation. Once full cardiopulmonary bypass was established, the pericardium was fully opened. The heart was elevated, the sewing cuff was attached to the LV approximately 1 cm anterior to the left ventricular

apex with 2-0 Ethibond pledgeted sutures and the myocardium was cored with the HeartMate coring knife. The inflow conduit was inserted into the left ventricle, and the device was secured with a locking mechanism. The outflow graft was trimmed for length and anastomosed to the ascending aorta. The driveline was externalized with a double-tunnel technique, exiting through the upper quadrant of the abdominal wall. The procedure was performed with the use of the heart lung machine but without cross clamping the aorta. Cardiopulmonary bypass lasted 53 minutes, and the total operative time of the straight forward procedure was 126 minutes.

Postoperative Care: The patient tolerated the procedure well with minimal blood loss and no other complications. He was transported to the cardiac intensive care unit in stable condition. Postoperative management included intravenous heparin as a bridge until anticoagulation with phenprocoumon reached a therapeutic range (INR 2.0 to 3.0), plus aspirin at 100 mg/day. The patient was extubated 7 hours postoperatively. The total hospital stay was 19 days. No readmission was required.

Results

Immediate postoperative Outcome: The postoperative chest X-ray reveals the placement of the HeartMate 3 left ventricular assist device at the apex of the left ventricle, with the percutaneous driveline extending along the diaphragm toward the right upper quadrant of the abdomen. (Figure 1). No congestion of the lungs and no postoperative pleural effusion were seen.

At one year of follow up: The patient was monitored closely, with vital signs, laboratory data, and echocardiogram results recorded from pre-implant to 1 Year post-implantation (Table 1).

A year after the implantation, the patient remained at home with New York Heart Association (NYHA I) Functional Class I symptoms and exercised regularly.



Figure 1: The postoperative chest X-ray reveals the placement of the HeartMate III left ventricular assist device at the apex of the left ventricle, with the percutaneous driveline extending along the diaphragm toward the right upper quadrant of the abdomen.

Variables	Pre-implant	Week 1	Discharge	Month 1	Month 6	1 Year
Vital signs						
Respiratory rate, breaths/min	20	21	17	19	14	15

Heart rate, beats/min	53	91	93	88	67	71
Blood pressure mean, mm Hg	62	106				
Doppler blood pressure, mm Hg			78	90	93	72
Pump parameters						
Pump flow, liters/min	NA	3,9	4,1	4,3	4,7	4,4
Pump speed, rpm	NA	5300	5400	5400	5400	5300
Pulsatility index	NA	4,9	3,8	4,1	3,2	3,6
Power, W	NA	3,6	4	4	3,8	4,2
Laboratory data						
Lymphocytes, %	22,4	22,9	22,3	21,4	27,9	31
Platelets, x 1,000/ml	183	196	296	322	321	265
White blood cells, x 1,000/ml	5,4	9,8	7,2	10,5	9,8	12,1
Hemoglobin, g/dl	13,2	12,1	11,9	12,2	12,4	14,2
International normalized ratio (INR)	1,01	1,3	2,31	2,7	2,5	2,41
Lactate dehydrogenase, U/liter	230	280	215	235	241	226
AST, U/liter	26	14	16	12	15	16
ALT, U/liter	27	8	12	9	12	9
Total bilirubin, µmol/liter	10	5	6	3	5	4,5
BUN	7,9	3,2	4,1	4,6	4,2	5
Creatinine, µmol/liter	136	79	82	88	75	78
Uric acid, µmol/liter	512	451	285	367	422	261
Sodium, mmol/liter	146	131	137	140	137	139
Potassium, mmol/liter	5,1	4,7	4,5	3,9	4,2	4,1
Total protein, g/liter	69	49	63	69	72	71
Echocardiogram: Left ventricular						
Ejection fraction, %	20	NA	21	27	32	26
Systolic dimension, mm	82	NA	80	87	NA	83
Diastolic dimension, mm	89	NA	79	72	76	71
Aortic valve open	NA	Yes	Yes	Yes	No	No
Mitral regurgitation	II	NA	II	I-II	None	None
ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; NA, not applicable/available.						

Table 1: Patient's Vital Signs, Echocardiogram, and Laboratory Data

Discussion

Significance of the Case: The successful implantation of the HeartMate 3 LVAD in this patient represents a significant milestone for cardiac care in Iraq. This case highlights the feasibility and safety of advanced cardiac procedures in resource-limited settings, paving the way for future heart transplantation programs.

Challenges and Solutions: Implementing such a complex procedure in Iraq posed several challenges, including restricted access to advanced medical equipment, infrastructure limitations, and a shortage of trained medical personnel. Overcoming these challenges involved comprehensive training programs for local healthcare providers, collaboration with international medical institutions, and the establishment of sustainable funding strategies.

Comparative Outcomes: The patient's recovery and improved functional status are comparable to international standards, demonstrating that with appropriate planning and resources, advanced cardiac care can be successfully implemented in developing countries.

Conclusion

The first successful implantation of the HeartMate 3 LVAD in Iraq marks a pivotal moment in the nation's medical history. This case not only improves the quality of life for the patient but also sets a precedent for

future cardiac care advancements in the region. Establishing a heart transplantation program in Iraq now seems attainable, given the successful outcome of this procedure. Continued international collaboration and investment in healthcare infrastructure are essential to sustain and expand these advancements.

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