

Editorial



Trends of Left Ventricular Assist Device Implantation and Heart Transplantation in Korea

Min-Seok Kim , MD¹, Jaewon Oh , MD², Jin-Oh Choi , MD³, and Seok-Min Kang , MD, PhD²

¹Division of Cardiology, Department of Internal Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

²Division of Cardiology, Department of Internal Medicine, Severance Cardiovascular Hospital, Cardiovascular Research Institute, Yonsei University College of Medicine, Seoul, Korea

³Division of Cardiology, Department of Medicine, Samsung Medical Center, Sungkyunkwan University College of Medicine, Seoul, Korea

OPEN ACCESS

Received: May 2, 2024

Revised: Jul 5, 2024

Accepted: Aug 8, 2024

Published online: Aug 19, 2024

Correspondence to

Seok-Min Kang, MD, PhD

Division of Cardiology, Department of Internal Medicine, Severance Cardiovascular Hospital, Cardiovascular Research Institute, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea.
Email: smkang@yuhs.ac

Copyright © 2024. Korean Society of Heart Failure

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

The prevalence of heart failure (HF) is on the rise, leading to an increase in the incidence of advanced HF.¹ Advanced HF is characterized by a lack of response to optimal medical or device therapy, necessitating surgical intervention, as outlined in various HF guidelines.^{2,3} Many of these patients experience frequent hospitalizations due to worsening HF and often encounter challenges in discontinuing inotropes. Furthermore, for those ineligible for surgical intervention, palliative care such as hospice treatment becomes necessary.

Surgical interventions for advanced HF primarily comprise left ventricular assist device (LVAD) implantation and heart transplantation. LVAD implantation serves as a bridge to transplantation (BTT) or destination therapy (DT) for patients ineligible for transplantation. Additionally, LVAD may be performed with the goal of considering transplantation in the future when the condition of the patient stabilizes, known as bridge to candidacy. Heart transplantation remains the gold standard therapy.⁴ Despite being a conventional treatment modality, it continues to evolve with ongoing developments in organ preservation, expansion of the donor pool, desensitization protocol, and post-transplant care.⁵

Although heart transplantation has historically been associated with favorable clinical outcomes, recent studies have indicated comparable results with the use of HeartMate 3™ (HM3) (Abbott Laboratories, Lake Forest, IL, USA) in treating advanced HF.^{6,7} Nevertheless, there is limited data available on the status of surgical treatments for advanced HF in Korea. Particularly, the nationwide landscape of LVAD implantation has not been fully elucidated. Therefore, this paper aims to address this gap by exploring the current state of surgical treatments for advanced HF in Korea and identifying any existing challenges in the field.

LVAD implantation was introduced into clinical practice in Korea in the early 2000s, with the first official case reported in 2004.⁸ However, due to the high cost and lack of coverage by the Korean National Health Insurance, their utilization remained limited to a small scale. Despite subsequent introductions of the HeartMate II™ (Thoratec Corp., Pleasanton, CA, USA) ventricular assist system in 2012 and HeartWare™ Ventricular Assist Device (HVAD; HeartWare International, Inc., Framingham, MA, USA) in 2015, there has been no significant increase in domestic use. However, after receiving approval for the Korean National Health Insurance coverage in September 2018, the number of LVAD implantations has seen a significant rise (**Figure 1**). While these data are compiled from the records provided by LVAD companies and

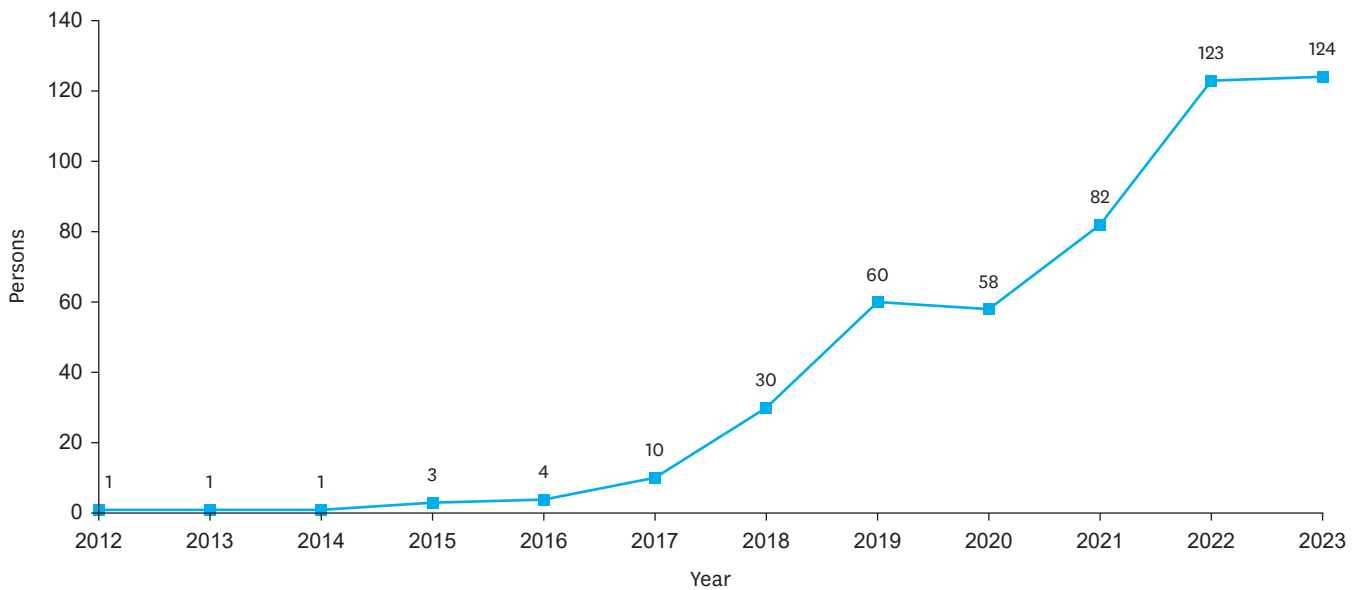


Figure 1. Statistics of left ventricular assist device (source: research from Abbott Korea and Medtronic Korea).

may have limitations regarding data collection, they underscore the increasing trend of LVAD implantation in Korea. Moreover, the initial implementation in six centers in 2018 has evolved, with surgeries now being performed in 17 centers by 2023, with expectations for continued growth in the number of centers. Following the introduction of HM3 in 2019 and the withdrawal of HVAD from the market due to safety concerns in 2020, only HM3 is presently available for adult patients in Korea. There is a notable contrast between the two devices, as HM3 demonstrates superior composite outcomes, including survival to transplant, recovery, or LVAD support without debilitating stroke or the need for pump replacement, along with overall survival.^{9,10} Furthermore, despite the current exclusivity of HM3 in Korea, reports indicate that real-world data on HM3 closely align with transplantation outcomes.^{6,7} These factors suggest that the use of HM3 in advanced HF in Korea is expected to continue, whether for BTT or DT.

Heart transplantation has seen a steady increase since the 1990s, despite a slight slowdown, likely attributed to reduced donor availability amid the coronavirus disease 2019 pandemic. Nevertheless, heart transplantation continues to be performed at an annual rate of approximately 150–200 cases (**Figure 2**). As the number of patients with HF in Korea is expected to rise, so too is the demand for heart transplants. However, several areas still require attention, including the aging of both recipients and donors, the rising trend of LVAD-bridged transplants, the growing prevalence of combined organ transplants, and the increasing number of sensitized candidates.¹¹ Addressing these challenges will necessitate further advancements across various domains, such as refining

allocation policies, implementing nationwide initiatives to boost donor numbers, enhancing primary graft dysfunction management, and optimizing desensitization protocols.

When considering surgical treatments for advanced HF in Korea, several important aspects warrant further consideration. First, there are concerns regarding the requirement for LVAD implantation to be exclusively performed at centers conducting heart transplantation. This may lead to impractical transplantations at centers with fewer transplantation cases, simply to fulfill criteria. Moreover, as the number of centers expands, there is a pressing need for quality control measures. However, evaluating these measures poses challenges due to the limited number of cases. Additionally, the absence of a centralized control tower to oversee operations adds to the complexity. While evaluations for LVAD implantation are conducted by the Health Insurance Review and Assessment Service before surgery, there is a lack of structured post-surgery monitoring systems. Furthermore, nationwide data collection on LVAD implantation is currently insufficient, so it is difficult to ascertain nationwide surgical outcomes. Despite discussions on establishing a Korean Mechanical Circulatory Support (a provisional name; K-MACS) registry led by the Korean Society for Thoracic and Cardiovascular Surgery, results have yet to be announced. To address these challenges and maintain domestic data on the status of LVAD implantations, long-term funding, investment, and sustained interest are crucial.

Advanced HF is the terminal stage within the spectrum of HF. Surgical interventions, warranted when pharmacological or device

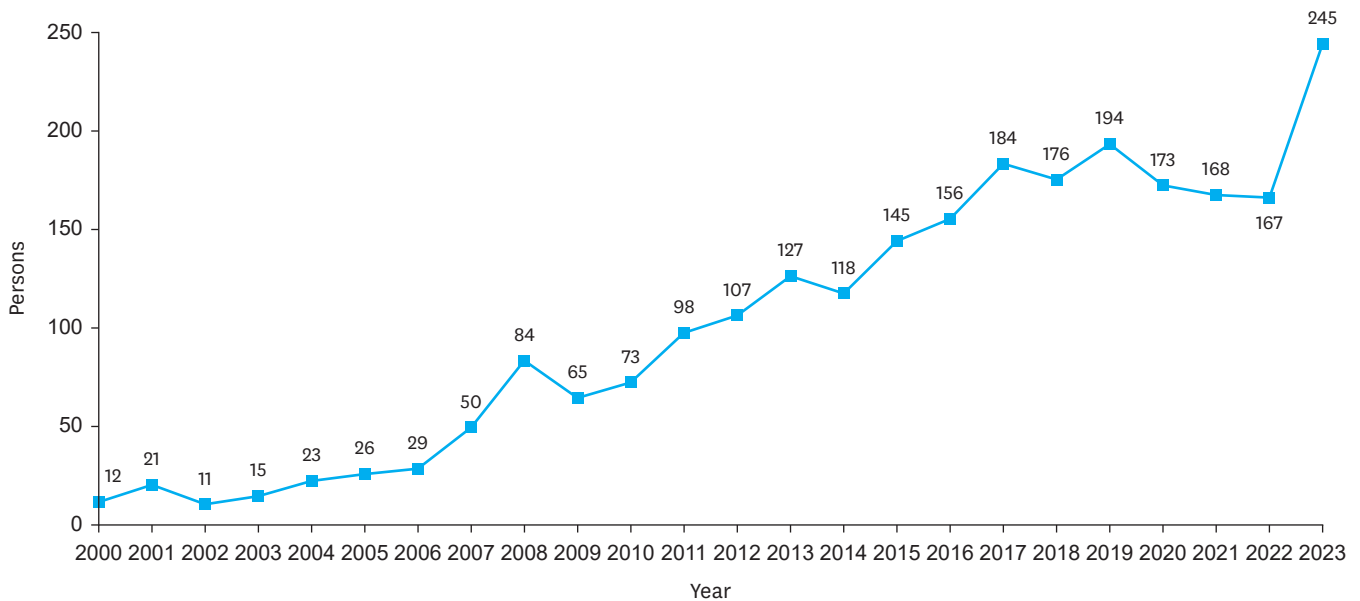



Figure 2. Statistics of heart transplantation (source: The Korean Network for Organ Sharing [2023]).

therapies are no longer effective, have seen significant advancements in recent years. Ranging from mechanical circulatory support such as LVAD implantations to traditional treatments such as heart transplantation, these interventions aim to enhance the quality of life and survival of patients with HF. However, there has been a scarcity of reporting on the current status and challenges in Korea regarding these interventions. Accurate perception and evaluation of the current treatment landscape are crucial for facilitating the development of future treatments. It is therefore imperative to maintain ongoing interest and engage in critical reflection on our current medical practices.

ORCID iDs

Min-Seok Kim 
<https://orcid.org/0000-0003-0860-3650>
 Jaewon Oh 
<https://orcid.org/0000-0002-4585-1488>
 Jin-Oh Choi 
<https://orcid.org/0000-0002-2441-2267>
 Seok-Min Kang 
<https://orcid.org/0000-0001-9856-9227>

Conflict of Interest

The authors have no financial conflicts of interest.

Author Contributions

Conceptualization: Kim MS, Oh J, Choi JO, Kang SM; Data curation: Kim MS, Oh J, Choi JO, Kang SM; Writing - original draft: Kim MS.

REFERENCES

1. Truby LK, Rogers JG. Advanced heart failure: epidemiology, diagnosis, and therapeutic approaches. *JACC Heart Fail* 2020;8:523-36. [PUBMED](#) | [CROSSREF](#)
2. Hyun J, Cho JY, Youn JC, et al. Korean Society of Heart Failure guidelines for the management of heart failure: advanced and acute heart failure. *Int J Heart Fail* 2023;5:111-26. [PUBMED](#) | [CROSSREF](#)
3. McDonagh TA, Metra M, Adamo M, et al. 2021 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure: developed by the task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). With the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur J Heart Fail* 2022;24:4-131. [PUBMED](#) | [CROSSREF](#)
4. Chun KH, Kang SM. Advanced heart failure: a contemporary approach. *Korean J Intern Med* 2023;38:471-83. [PUBMED](#) | [CROSSREF](#)
5. Coniglio AC, Bryner BS, Devore AD, Patel CB. Trends in cardiovascular medicine: update on cardiac transplantation. *Trends Cardiovasc Med* 2023;33:46-50. [PUBMED](#) | [CROSSREF](#)
6. Varshney AS, DeFilippis EM, Cowger JA, Netuka I, Pinney SP, Givertz MM. Trends and outcomes of left ventricular assist device therapy: JACC focus seminar. *J Am Coll Cardiol* 2022;79:1092-107. [PUBMED](#) | [CROSSREF](#)
7. Kirschner M, Topkara VK, Sun J, et al. Comparing 3-year survival and readmissions between HeartMate 3 and heart transplant as primary treatment for advanced heart failure. *J Thorac Cardiovasc Surg* 2023;S0022-5223(23)01207-2. [PUBMED](#) | [CROSSREF](#)
8. Lee S, Park YH, Lim SH, Kwak YT, Kim H, Chang BC. Successful mechanical circulatory support as a bridge to transplantation. *Asian Cardiovasc Thorac Ann* 2007;15:243-5. [PUBMED](#) | [CROSSREF](#)
9. Mehra MR, Naka Y, Uriel N, et al. A fully magnetically levitated circulatory pump for advanced heart failure. *N Engl J Med* 2017;376:440-50. [PUBMED](#) | [CROSSREF](#)

10. Mehra MR, Goldstein DJ, Cleveland JC, et al. Five-year outcomes in patients with fully magnetically levitated vs axial-flow left ventricular assist devices in the MOMENTUM 3 randomized trial. *JAMA* 2022;328:1233-42. [PUBMED](#) | [CROSSREF](#)
11. Kim IC, Youn JC, Kobashigawa JA. The past, present and future of heart transplantation. *Korean Circ J* 2018;48:565-90. [PUBMED](#) | [CROSSREF](#)