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Patients' decision making process and expectations of a left ventricular assist device pre and post implantation

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INTRODUCTION

Heart failure (HF) impacts nearly 6 million Americans with 10% of patients considered to be at an advanced stage of disease.¹ It is anticipated that the prevalence of HF will continue to rise with 8 million expected diagnoses by 2030.² Continued advances in patient management will increase the number of patients surviving to develop advanced stage D HF. Currently, 5% to 10% of all HF patients are classified as Stage D as defined by the presences of progressive, persistent signs and symptoms of HF despite optimal medical, surgical, or device management.³ Heart transplantation is one of the most promising treatment options for Stage D HF patients, however organ scarcity has made heart transplantation an improbable treatment modality.⁴⁻⁵ Moreover, many Stage D HF patients do not meet the minimum eligibility standards for transplant.⁶ Therefore, alternative strategies have been developed for the treatment of advanced HF including left ventricular assist devices (LVADs).

LVADs were originally developed as a bridge to transplantation (BTT) for patients awaiting heart transplant and are now being used as destination therapy (DT) for patients who are not transplant eligible due to advancing age and comorbidities.⁷ As of 2014, LVAD implantations have reached almost 2500 per year with more than 40% of devices implanted as DT.⁷ The main goals of LVAD implantation are to improve quality of life, improve

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survival, and help to decrease the number of inpatient hospital days experienced by chronic, advanced HF patients.^{5,7-9} Currently, the one year survival rate after LVAD-DT implantation is 68% and the 2-year survival rate is 58% as compared to 10% (2-year) for those patients who forego implant and are medically managed.⁷ Improvements in quality of life are seen at 3 months after implantation and remain stable through the duration of support for patients implanted for both BTT and DT.¹⁰ Although the increase in quantity and quality of life are positive outcomes with LVADs, they also pose significant risks and burdens to patients. The majority of patients experience a major adverse event within 2 years of implantation including: disabling stroke, replacement of a failed or malfunctioning pump, and death.¹¹ Thrombosis, right ventricular failure, bleeding, life-threatening arrhythmias, infection, and frequent hospital readmissions are also common.¹² Advancing age and existing medical comorbidities are two of the primary reasons patients may be considered for LVADs; however, even after successful LVAD implantations, these patients still have progressive chronic illnesses and advancing age.¹¹⁻¹⁵ LVAD implantation often occurs during a period of rapid clinical decline and medical instability and in many cases consent is obtained on an emergent basis.

Little is known about the patient's decision-making process prior to LVAD implantation, expectations for the LVAD, and whether these expectations were met post-implantation. Recent studies indicate that most patients feel gratitude for receiving the LVAD as it has improved quality of life; however, they also report little recollection of the decision to implant due to their failing health at the time of the consent.¹⁶ In addition, some patients have reported feeling they had little choice but to consent when facing the alternative of death; whereas others made unrushed, thoughtful decisions to implant.⁸ The literature highlights a need for improved patient/provider conversations, prior to implantation, that ensure patient appreciation of risks, benefits, and burdens of LVAD implantation and outline realistic expectations post-implantation.¹⁶⁻¹⁸ Palliative care involvement from the pre-implantation decision through the post-implantation is recommended and guidelines specific to mechanical circulatory support that provide well defined methods to engage patients in discussions regarding goals of care, values and preferences.¹⁹ The decision to consent to LVAD implantation is complex given the considerable risks and burdens associated with implantation. Therefore, the purpose of this study was to examine the patient's pre-implantation decision-making process and expectations for the device both pre and post-implantation.

METHODS

Study Design

A longitudinal qualitative design using in-depth, semi structured interviews was used for data collection and analysis. A descriptive thematic analysis as described by Miles, Huberman, and Saldana was utilized.²⁰ Qualitative methodology was chosen in order to gain a comprehensive understanding of the pre-implantation decision-making process and post-implantation expectations and is appropriate due to the lack of existing data exploring this phenomenon. The longitudinal design with serial interviews was incorporated to examine the experiences of participants over time to better capture the evolving and dynamic

experience.²¹ The study was approved by the University's Institutional Review Board. Written informed consent was obtained from all participants upon enrollment. Participants were compensated for their time.

Participant Recruitment

This secondary analysis used semi-structured interviews from a longitudinal study of the palliative care needs of participants with Stage D HF, when the patient had a predicted survival of less than two years as determined using the Seattle Heart Failure Model.²² (NIH/ NINR XXX). Participants were interviewed individually monthly for up to two years or until the patient's death. A total of 15 participants had LVADs implanted and were included in this sub- analysis.

Data Collection

Initially, all LVAD participants were interviewed using the guide developed for the parent study. The monthly interviews all included similar probes, but were framed to ask specific questions based on a patient's individual parameters. The probes for the LVAD recipients included questions related to the patient's perspective on the LVAD decision-making process prior to implant, and expectations for the LVAD pre- and post-implantation.

The interview guide was developed congruent with the longitudinal design of the study. The pre-LVAD interviews contained questions addressing: the decision-making process preimplantation, the information provided by healthcare providers during the decision-making process including other treatment options, and the pre-implantation expectations of living with the LVAD. The follow-up interviews contained questions to capture the post-implantation experiences and the patient's future expectations of living with an LVAD. The initial interviews were 45-60 minutes in length and the monthly follow-up interviews averaged 15-20 minutes in length. Participants were followed on a monthly basis for two years or until death of the participant, whichever came first. Interviews were digitally recorded, professionally transcribed, de-identified, and verified for accuracy prior to analysis by the research team.

Data Analysis

A qualitative thematic approach was used for the analysis of the raw data.²⁰ The initial codebook was developed based on the domains addressed in the interview guide and was further refined throughout the analysis process incorporating both the initial domain codes and data driven codes. Independent coding of caregiver interviews was conducted by the research team consisting of the parent study's two PIs and two PhD students. An iterative process of coding followed by team analysis and data immersion occurred with the initial interviews and then with the follow-up interviews. The longitudinal data set was analyzed to provide a rich thematic description.²³ Findings were confirmed at a group analysis session using an iterative team-based approach. The research team concluded that thematic saturation was reached as additional interview data was consistent with existing data and no new themes emerged.

Several strategies were employed to ensure the trustworthiness of the data and subsequent findings throughout the analysis process. To assure dependability, an audit trail was documented during the team analysis sessions. Any discrepancies in coding were reviewed by the research team and discussed among the coders and investigators until a consensus was met. To assure credibility, the final codes and subsequent thematic description was agreed upon by all members of the multidisciplinary research team.

RESULTS

Demographics

The study included 15 participants who received an LVAD (11 males and 4 females). The participants ranged in age from 39-75 years of age (mean 59) and were 93% white. The reason for LVAD implantation was for destination therapy (n=5) and as a bridge to transplant (n=10). All of the participants had an axial flow design LVAD implanted

Qualitative Themes

Participants described in detail the decision-making process and provided rich descriptions of their post-implantation experiences and expectations in the follow-up interviews. Analysis revealed three consistent themes in both the DT and BTT participants. The main theme in the pre-implantation period was: *no choice*. The main themes in the post-implantation period were: *I thought I would be doing better*, and *I feel good, but now what*.

Pre-Implantation: No choice—As participants transitioned from Stage D heart failure to device placement, many participants expressed feelings of having no choice but to accept device implantation. In many cases, the potential of LVAD implantation had been an ongoing discussion with the healthcare team. When the discussion transitioned into a time when a decision had to be made, the participants were living with high symptom burden and death was seen as the only alternative. For those participants who had been medically managed at a community hospital, the transfer to the LVAD center during an acute episode was, for many, the first time the LVAD was discussed as an option. Regardless of the place of treatment prior to the LVAD, participants described the decision as “no choice.” Participants remarked,

“There is no decision when they give you the alternative...I am not ready to die”

“There was no question about it. If I wanted to live that was my choice I had to make.”

The feelings of no choice regarding the decision did not seem related to the indication for device implantation with BTT participants as likely as DT participants to express feelings of helplessness.

The pre-implantation period was described as a “busy and overwhelming time” in which they saw many healthcare providers and had multiple consults and tests. Participants described how sick they were during this time period and if risks were discussed by the healthcare team, they did not recall that discussion or risks did not factor it into the decision when the alternative was hospice or death. Participants felt the decision-making process and

the discussion of the risks was probably harder on their family due to their medical instability and high symptom burden during this time period. When participants were asked if they utilized sources other than the health care team for additional information during the decision-making process, some reported they searched the web and viewed industry sponsored websites. The participants described the information on websites as positive with participants “returning to normal” and “skiing with the device.”

Post-Implantation: *I thought I would be doing better*—After receiving the LVAD, participants provided rich descriptions of living with the device and their expectations post-implantation which closely aligned with their perceptions of quality of life. Many participants indicated that expectations of how they would be doing were unmet following implantation. Participants that were experiencing setbacks in their recovery due to issues such as infection or persistent symptoms related to heart failure such as fluid overload were more likely to fall into this category expressing that they expected more significant improvements with the device in place. One patient commented,

“I have had just as many admissions as with my heart failure...I remember them telling me the risks like infection before I got the device, but not sure I was listening.”

Another patient reported,

“I thought when they put it in I was going to be fine and be able to do everything like I used to...well that is not the way it is. When they put it in I had 20% function and I still have only 20% function. Plus some infections and gout to go with it...But it is better than the alternative.”

In most cases even though the LVAD may not have met expectations, participants expressed that they were “happy to be alive.”

Many participants did describe an improved quality of life and decreased symptom burden in the post-implantation period, however still did not feel the LVAD had met their expectations. One patient reported,

“They had me talk to someone who was skiing after his implant...I am nowhere near there...don't think I ever will be....this has not fixed my heart failure”

Post-Implantation: *I feel good, but now what?*—Participants with good outcomes following device implantation were pleased with their progress; however, those who received the implant as a bridge to transplant felt a sense of limbo with the device in place. One patient remarked,

“I received the LVAD as a bridge to transplant...I am medically stable and that is good, but now I am not moving on the transplant list...the LVAD is really a double-edge sword because I feel like it is keeping me from getting a heart.”

Another patient who was eventually a transplant recipient expressed similar feelings,

“They had put an LVAD in me and then that went bad within 90 days and so they put another one in me and within 90 days that went bad...I did not feel bad, but anxious to get my heart.”

In many cases, the participants remained on the transplant list during their entire two-year time period in the study. In some cases participants who received the LVAD as a bridge to transplant developed a driveline infection and were subsequently removed from the transplant list.

The majority of participants described the decision-making process not as a process but as a means to their future survival. However, it was evident that the post-implantation reality did not meet the patient's pre-implantation expectations regarding the LVAD. The main theme preimplantation was, “The device will save my life” which transitioned into, “I thought I would be feeling better” as the main theme in the post-implantation period. This theme was particularly salient in participants who received an LVAD as destination therapy.

DISCUSSION

This study highlights the challenges of the decision-making process which is occurring at a time when patients are living with an end-stage illness and in many cases during a period of rapid clinical decline. Previous studies have described the decision making process only during the pre-implantation period using cross-sectional study design.⁸ However, this study is the first to explore the decision-making process prospectively with longitudinal follow-up of participants after LVAD implantation to explore participant expectations in both the pre and post implantation period.

The majority of the participants described the decision-making experience of consenting to LVAD implantation as “No choice” and although similar findings have been reported in the literature,^{8,16} this remains a challenge for both patients who are consenting for an LVAD and also for health care providers during the consent process. This finding has important ethical implications. If the patients perceive LVAD implantation as the only option this results in a loss of autonomy. Clinicians need to describe the available alternatives including optimal medical management so that patients clearly understand they do have a choice. It is imperative in the preimplantation period that ongoing discussions with realistic expectations of all options are presented to patients. Participants also reported that they did not remember much of the preimplantation period due to the severity of their symptoms. This finding highlights the need for family involvement during the decision making process.

The discord in pre- and post-implantation expectations is a new finding. Failure of the LVADs to meet pre-implantation expectations of improved quality of life has important clinical implications. This finding is of particular significance in the destination therapy group who, in the majority of cases, will live and die with this device in place, regardless of the cause of death. Patients who have unrealistic expectations of quality of life improvements could potentially complicate advance care planning and end-of-life discussions with both the patient and the family.

The discord in patient expectations from pre-implantation to post-implantation is also intriguing from a quality of life perspective. In the post-implantation period, although patients were “happy to be alive,” it was clear that the patient's quality of life did not reach the preimplantation expectations. This expectation is not congruent with current evidence. In a longitudinal study by Grady et al., patient perceptions of health status and quality of life was relatively stable between 1 month and 1 year post-implantation in both BTT and DT patients.²⁴ Similar outcomes are reported by Kirklin et al. from The Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) data in which quality of life improved from preimplantation to post-implantation period but remained stable from 6 months post-implantation through 2 years.⁷ In a systematic review, it was found that improvements in quality of life and physical functioning are seen at 3 months post-implantation and remain stable throughout the duration of support.²⁵ Similar findings are reported in a mixed methods study in which improved quality of life was reported early after implantation but emotional distress remained high.²⁶ It should be noted that the current body of knowledge related to quality of life and emotional distress in the post implantation period remains limited. Additional studies addressing quality of life over time capturing individual change are needed including both general quality of life measures such as the European Quality of Life-5 Dimensions (EQ5D) and measures specific and sensitive to the LVAD population such as mixed methods and qualitative studies.

A limitation of the study was the homogeneity of the sample; consisting primarily of white male participants. Although participants were recruited from multiple sites, all LVAD implantations occurred at one academic medical center. Future studies should include a more diverse sample from multiple settings. This prospective longitudinal study of patient expectations from the pre-implantation to post-implantation period provides new contributions to the limited body of knowledge in this area. However, it also highlights the significant areas in which additional studies are needed. Future studies are needed to provide longitudinal quality of life data as patients are now living and dying with LVADs in place. Additional evidence is needed to guide the structure and *timing* of iterative palliative care involvement beyond the initial preimplantation consultation through the post-implantation period and during times of relative medical stability as well as times of medical instability. As many participants do not recall the pre-implantation period due to declining health, involving families and caregivers in the decision making is an essential part of the process.

CLINICAL IMPLICATIONS

The suggestion of palliative care involvement from the pre-implantation decision through the post-implantation period including the end of life is supported in the literature.¹⁹ Swetz et al. have provided guidelines for preparedness planning specific to mechanical circulatory support that provide well defined methods to engage patients in discussions regarding goals of care, values and preferences.¹⁹ The addition of a palliative care specialist during the pre-implantation period is a requirement of the Joint Commission for the disease-specific care advanced certification program for Ventricular Assist Device for Destination Therapy.²⁷ However, the specific guidelines for palliative care involvement post-implantation are not clear. The introduction of the palliative care team during the pre-implantation period is a critical first step, but the role of the palliative care team in the post-implantation period,

especially in those patients who experience lower symptom burden is still vague. This has the potential to further complicate decisions that inevitably will need to be made at the end of life. Although device technology continues to improve with resulting benefits in both quantity and quality of life, many patients will experience an adverse event that may impact their quality of life. As part of the preparedness planning advocated by Swetz et al., it is essential to continue to have frank discussions and provide realistic expectations to patients and families, throughout the post-implantation period.¹⁹ Palliative care should be viewed as a philosophy of care and should occur as an iterative process addressing changing goals of care as patients live with an LVAD. This should include not only destination therapy patients but also bridge to transplant patients as many of these patients will be living long term with an LVAD due to the scarcity of available organs. Evidence based guidelines should be developed that provide protocols for palliative care, including when involvement should occur in the post-implantation period. The timing of palliative care re-consultation and goals of care discussions may be particularly challenging in those patients who are doing well clinically post-implantation.

CONCLUSIONS

The decision-making process prior to implantation will remain challenging in a setting of increasing symptom burden. In light of their declining health prior to LVAD implantation, most participants felt the only other option was death, which was not viewed as an acceptable alternative. Ongoing discussions of goals of care by the healthcare team with the patient and family are critical in the pre-implantation period. Discussions should include risk and benefits of all options as well as expected quality of life after device implantation. In the post-implantation period, participants' pre-implantation quality of life expectations were not met, highlighting the need for iterative goals of care discussions with description of realistic expectations based on current evidence. Ongoing palliative care involvement is recommended in the post-implantation period and evidence based guidelines are needed to guide goals of care discussions that are balanced with realistic expectations.

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References

1. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, de Ferranti S, Després J-P, Fullerton HJ, Howard VJ, Huffman MD, Judd SE, Kissela BM, Lackland DT, Lichtman JH, Lisabeth LD, Liu S, Mackey RH, Matchar DB, McGuire DK, Mohler ER 3rd, Moy CS, Muntner P, Mussolino ME, Nasir K, Neumar RW, Nichol G, Palaniappan L, Pandey DK, Reeves MJ, Rodriguez CJ, Sorlie PD, Stein J, Towfighi A, Turan TN, Virani SS, Willey JZ, Woo D, Yeh RW, Turner MB, on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015; 131:e1–e295. Retrieved from <http://circ.ahajournals.org/content/early/2014/12/18/CIR.0000000000000152>. [PubMed: 25561477]

2. Heidenreich PA, Albert NM, Allen LA, et al. Forecasting the impact of heart failure in the United States: A policy statement from the American Heart Association. *Circulation*. 2013; 6:606–619. [PubMed: 23616602]
3. Fang JC, Ewald GA, Allen LA, Butler J, WestlakeCanary CA, Colvin-Adams M, Dickinson MG, Levy P, Gattis Stough W, Sweitzer NK, Teerlink JR, Whellan DJ, Albert NM, Krishnamani R, Rich MW, Walsh MN, Bonnell MR, Carson PE, Chan MC, Dries DL, Hernandez AF, Hershberger RE. Advanced (stage D) heart failure: A statement from the Heart Failure Society of America guidelines committee. *Journal of Cardiac Failure*. 2015; 21(6):519–534. [PubMed: 25953697]
4. Deng M. Orthotopic heart transplantation: highlights and limitations. *The Surgical Clinics of North America*. 2004; 84(1):243–255. [PubMed: 15053192]
5. Radovancevic B, Frazier O. Surgical therapies for heart failure. *Current Opinions in Cardiology*. 2000; 15(3):161–165.
6. Miller L. Is left ventricular assist device therapy underutilized in the treatment of heart failure? *Circulation*. 2011; 122:1552–1558. [PubMed: 21482973]
7. Kirklin JK, Naftel DC, Pagani FD. Sixth INTERMACS report: A 10,000-patient database. *Journal of Heart and Lung Transplantation*. 2014; 33(6):555–564. [PubMed: 24856259]
8. McIlvennan CK, Allen LA, Nowels C, Brieke A, Cleveland JC, Matlock DD. Decision making for destination therapy left ventricular assist devices. *Circulation: Cardiovascular Quality Outcomes*. 2014; 7:374–380. [PubMed: 24823949]
9. Grady KL, Naftel D, Stevenson L, et al. Overall quality of life improves to similar levels after mechanical circulatory support regardless of severity of heart failure before implantation. *Journal of Heart and Lung Transplantation*. 2014; 33(4):412–421. [PubMed: 24360203]
10. Rogers JG, Aaronson KD, Boyle AJ, Russell SD, Milano CA, Pagani FD, Edwards BS, Park S, John R, Conte JV, Farrar DJ, Slaughter MS for the HeartMate II Investigators. Continuous flow left ventricular assist device improves functional capacity and quality of life of advanced heart failure patients. *Journal of the American College of Cardiology*. 2010; 55(7):1826–34. [PubMed: 20413033]
11. Slaughter MS, Rogers JG, Milano CA, et al. Advanced heart failure treated with continuous-flow left ventricular assist device. *The New England Journal of Medicine*. 2009; 361:2241–2251. [PubMed: 19920051]
12. Birati E, Rame JE. Left ventricular assist device management and complications. *Critical Care Clinics*. 2014; 30:607–627. [PubMed: 24996611]
13. Casida J, Marcucci L, Peters R, Wright S. Lifestyle adjustments of adults with long-term implantable left ventricular assist devices: A phenomenological inquiry. *Heart and Lung*. 2011; 40:511–520. [PubMed: 21722957]
14. Kitko LA, Hupcey JE, Gilchrist JH, Boehmer JP. Caring for a spouse with end-stage heart failure through implantation of a left ventricular assist device as destination therapy. *Heart and Lung*. 2013; 42:195–201. [PubMed: 23499234]
15. Flint KM, Matlock DD, Lindenfeld J, Allen LA. Frailty and the selection of patients for left ventricular assist device. *Circulation*. 2012; 5:286–293. [PubMed: 22438521]
16. Ottenberg AL, Cook KE, Topazian RJ, Mueller LA, Mueller PS, Swetz KM. Choices for patients “without a choice”- Interviews with patients who received a left ventricular assist device as destination therapy. *Circulation: Cardiovascular Quality Outcomes*. 2014; 7:368–373. [PubMed: 24823955]
17. Allen LA, Stevenson LW, Grady KL, et al. Decision making in advanced heart failure: A scientific statement from the American Heart Association. *Circulation*. 2012; 125:1928–1952. [PubMed: 22392529]
18. Bruce CR, Brody B, Majumder MA. Ethical dilemmas surrounding the use of ventricular assist devices in supporting patients with end-stage organ dysfunction. *Methodist DeBakey Cardiovascular Journal*. 2013; 9(1):11–14. [PubMed: 23518898]
19. Swetz KM, Kamal AH, Matlock DD, et al. Preparedness planning before mechanical circulatory support: A “how-to” guide for palliative medicine clinicians. *Journal of Pain and Symptom Management*. 2014; 47(5):926–935. [PubMed: 24094703]

20. Miles, MB.; Huberman, AM.; Saldana, A. Qualitative data analysis: A methods sourcebook. 3rd Ed. Sage; Thousand Oaks CA.: 2014.
21. Murray SA, Kendall M, Carduff E, Worth A, Harris FM, Lloyd A, Cavers D, Grant L, Sheikh. Use of serial qualitative interviews to understand patients' evolving experience and needs. *BMJ*. 2009; 339:b3702. [PubMed: 19786485]
22. Levy WC, Mozaffarian D, Linker DT, et al. The Seattle Heart Failure Model: Prediction of survival in heart failure. *Circulation*. 2006; 113(11):1424–1433. [PubMed: 16534009]
23. Saldana, J. Longitudinal Qualitative Research: Analyzing Change through Time. AltaMira Press; Walnut Creek, CA: 2003.
24. Grady KL, Naftel DC, Myers S, Dew MA, Weidner G, Spertus JA, Idrissi K, Lee HB, McGee EC, Kirklin JK. Change in health related quality of life from before to after destination therapy mechanical circulatory support is similar for older and younger patients: Analyses from INTERMACS. *Journal of Heart and Lung Transplantation*. 2015; 34(2):213–221. [PubMed: 25578625]
25. MacIver J, Ross HJ. Quality of life and left ventricular assist device support. *Circulation*. 2012; 126:866–874. [PubMed: 22891167]
26. Modica M, Ferratini M, Torri A, Olivia F, Martinelli L, De Maria R, Frigerio M. Quality of life and emotional distress after left ventricular assist device implant: A mixed methods study. *Artificial Organs*. 2015; 39(3):220–227. [PubMed: 25205291]
27. [November 1, 2015] The Joint Commission Disease-Specific Care Certification: Advanced Certification in Ventricular Assist Device. Available at http://www.jointcommission.org/certification/ventricular_assist_device.aspx.