Original paper

The impact of depression and anxiety symptoms on quality of life and social support in therapy with mechanical circulatory support devices: results for patients and their caregivers

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Key words: quality of life, depression, social support, anxiety, left ventricular assist devices.

Abstract

Introduction: Mechanical circulatory support (MCS) is a therapy increasingly used in patients with advanced heart failure. Left ventricular assist devices (LVAD) has the potential to improve patient's quality of life (QoL) significantly and may appreciably impact psychological functioning and social support among patients and their caregivers.
Aim of the research: Assessment of the impact of depression and anxiety symptoms on the QoL and social support in therapy with mechanical circulatory support devices among patients and their caregivers.
Material and methods: The analysis included 54 dyads of patients (median age: 61 years; men 96.30%) and their caregivers (median age: 59 years; men 3.70%). Data were collected 3 months after LVAD implantation. The study used the questionnaires SF-12, Berlin Social Support Scales, and the Hospital Anxiety and Depression Scale, and sociodemographic data.
Results: Caregivers of patients with LVAD assessed the QoL as better than patients (PCS 55.94 vs. 41.87; MCS 48.98 vs. 45.58). Significant differences were found in perceived social-emotional support, need for support, and support seeking. Patients had a higher level of this support. Patients had higher levels of depression and anxiety symptoms than their caregivers. Among patients, depression and anxiety symptoms hurt the mental domain of QoL and the perceived protective buffering of emotional support. Among caregivers, higher intensity of anxiety was associated with a greater need for protective buffering support and a lower need for perceived instrumental support. Predictors of QoL for patients included time since LVAD implantation, depression, and type of device, while among caregivers – age, time since LVAD implantation, and professional activity.
Conclusions: Psychological monitoring and the availability of support during care for the patient and caregiver are recommended.

Introduction

End-stage heart failure (HF) is the dominant cause of death worldwide, and long-term mechanical circulatory support (MCS), mainly left ventricular assist devices (LVAD), is one of the well-established surgical treatments for advanced HF [1]. Available one-year survival data of patients receiving modern continuous-flow LVADs is comparable to that of cardiac transplantation. However, post-implantation complications negatively influence patients' quality of life (QoL) with LVAD [2]. From the viewpoint of patients living with LVAD, QoL includes 5 domains (physical, cognitive, meaning/spiritual, emotional, and social) [3]. An interpretation of QoL in patients living with an LVAD has been settled as: 'Being well enough to do and enjoy day-to-day activities that are important to me' [3, 4].

The literature review highlights the crucial role of psychosocial factors in functional adaptation to illness for patients and caregivers [5]. Living with an LVAD is complex and requires dedicated around-the-clock patient care. Caregiver responsibilities range from simple tasks to complex procedures, causing significant stress and possibly affecting their health and QoL [6, 7]. Studies have emphasised that LVAD caregivers often suffer from stress and unpredictability and are exposed to poor psychological outcomes. The literature also indicates high levels of caregiver strain in VAD caregivers, who are known to sacrifice relationships, jobs, and livelihoods, straining their physical and emotional health [8, 9]. The 2018 International Society for Heart and Lung Transplantation consensus recommendations for evaluating potential recipients for heart transplantation and LVAD support define social support as a critical prerequisite for successful psychosocial adaptation, identifying it as a risk factor affecting patient outcomes [10]. A high level of social support can reduce stress and improve QoL among LVAD recipients and their caregivers [11].

Aim of the research

Evaluation of the depressive and anxiety symptoms in conjunction with QoL and social support among LVAD recipients and their caregivers.

Material and methods

Study design and study group

The study was a cross-sectional study. The study was conducted at the Clinical Department of Cardiovascular Surgery and Transplantology of Saint John Paul II Specialist Hospital in Krakow from 1.01.2022 to 31.12.2022. The study protocol complied with the Declaration of Helsinki and received a positive opinion from the Bioethics Committee KBKA/23/O/2021.

Study group

Patients and their caregivers meeting the following criteria were enrolled in the study: Age > 18 years, good cognitive status, co-residence with the patient/caregiver, first hospitalisation after LVAD implantation completed, and informed consent to participate. The exclusion criteria included age < 18 years, poor cognitive health, no caregiver, first hospitalisation after LVAD implantation, and participation in other clinical trials. In total, 54 patient-caregiver couples were enrolled in the study.

Research method

Diagnostic survey with standardised questionnaires:

1. SF-12 is a short-form health survey questionnaire. It includes a 12-item Physical Component Summary (PCS) and a Mental Component Summary (MCS). Scores for the 8 scales are calculated using the transformed scores (range: 0–100). The higher the score, the better the perceived health [12]. A license for the SF-12v2 was acquired from QualityMetric Incorporated (QM0557070, August 2021). Cronbach's coefficient alpha was 0.84 for PCS and 0.78 for MCS.

2. The Hospital Anxiety and Depression Scale (HADS) score range is 0–21; higher scores indicate greater anxiety and depression [13]. A score from 0 to 7 indicates a standard value; 8–10 points suggests the ceiling; from 11 to 21 is considered abnormal. Cronbach's coefficient alpha was 0.83 for anxiety, 0.62 for depression, and 0.75 for irritability.

3. The Berlin Social-Support Scales (BSSS) is a multidimensional measure of social support. The BSSS has 6 subscales: perceived emotional support, perceived instrumental support, need for support, support seeking, received support, and protective buffering. Scores are obtained by adding item responses (sum scores) or generating the scale mean score [14]. Cronbach's coefficient a ranged from 0.94 to 0.71.

Statistical analysis

Statistical analysis was performed in R software version 4.3.1. Values comparison of groups' qualitative variables (not expressed in numbers) was done with the χ^2 test (with Yates correction) or Fisher's exact test. A comparison of the values of quantitative variables (expressed in numbers) in 2 groups was done using the Mann-Whitney test. Correlations among quantitative variables were analysed with Spearman's correlation coefficient. Multivariate analysis of potential predictors' impact on a quantitative variable was done using linear regression. Results are presented as regression parameters with 95% confidence intervals. A significance level of 0.05 was adopted. SF-12 quality of life was calculated in PROCoRE Smart Measurement System Version 2.0.7653.27808.

Results

Patient and caregiver demographics

The dominant patient gender was male (96.3%) and female (96.3%) among caregivers. The median patient age was 61 years and 59 for caregivers. Patients were statistically significantly older than caregivers. The HeartMate II (HM, Thoratec Corporation, Pleasanton, CA, USA) was implanted in 37 patients and HeartWare (HW, Framingham, MA, USA) in 17. The mean duration of mechanical support was 3.11 ±1.84 years. Table 1 presents the demographic data.

Descriptive findings of quality of life, social support, and depression and anxiety

The Physical Component Summary (PCS) measured patients' physical QoL at 41.87. For caregivers, PCS was significantly higher, at 55.94. The patients' Mental Component Summary (MCS) was higher (48.98) than the PCS, while in caregivers it was lower (45.58) than the PCS. The MCS was significantly higher in caregivers than in patients.

Among patients, perceived instrumental support predominated. Caregivers reported more emotional support. Patients had significantly higher levels of instrumental support and a greater need for support than caregivers. Patients' support-seeking was also higher. Symptoms of depression or anxiety were absent, but these issues were significantly greater for patients than for caregivers. Irritability was stronger in patients. Table 2 gives detailed results.

Impact of depression and anxiety on the QoL and social support in patients

Analysis of depression and anxiety's impact on QoL and social support showed that anxiety intensity significantly correlated ($p < 0.05$) negatively ($r > 0$) with MCS, perceived instrumental support, and protective buffering support, indicating that higher anxiety

Table 1. Patient and caregiver demographics

Parameter	Patient (*n* = 54)	Caregiver (*n* = 54)	Total (*N* = 108)	*P*-value
Age				
Median (quartiles)	61 (55.25–67)	59 (50–61)	60 (54–65)	0.024*
Range	29–74	20–69	20–74	
N	54	53	107	
Gender, *n* (%)				
Male	52 (96.30)	2 (3.70)	54 (50.00)	< 0.001*
Female	2 (3.70)	52 (96.30)	54 (50.00)	
Place of living, *n* (%)				
Town	20 (37.04)	16 (29.63)	36 (33.33)	0.54
Village	34 (62.96)	38 (70.37)	72 (66.67)	
Employment, *n* (%)				
No	48 (88.89)	31 (57.41)	79 (73.15)	0.001*
Yes	6 (11.11)	23 (42.59)	29 (26.85)	
Education, *n* (%)				
High school or less	46 (85.18)	40 (74.08)	86 (79.63)	0.259
Higher	8 (14.81)	14 (25.93)	22 (20.37)	
Marital status, *n* (%)				
Single	2 (3.70)	0 (0.00)	2 (1.85)	0.021*
Married	51 (94.44)	48 (88.89)	99 (91.67)	
Divorced	1 (1.85%)	0 (0.00%)	1 (0.93%)	
Child of patients	–	4 (7.41)	4 (3.70)	
Other	0 (0.00)	2 (3.70)	2 (1.85)	

*p – Qualitative variables: χ^2 test or Fisher's exact test. Quantitative variables: Mann-Whitney test. *Statistically significant difference (p < 0.05).*

leads to lower MCS and support. Similarly, depression symptoms significantly correlated ($p < 0.05$) negatively ($r > 0$) with MCS and perceived instrumental support, indicating that greater depression results in lower MCS and support.

The impact of depression and anxiety on QoL and social support in caregivers

Caregiver anxiety correlates significantly ($p < 0.05$) and positively ($r > 0$) with protective buffering support, indicating that higher anxiety leads to increased protective buffering. Conversely, anxiety correlates significantly ($p < 0.05$) and negatively ($r > 0$) with perceived instrumental support, suggesting that greater anxiety results in lower perceived instrumental support.

Type of implanted device and QoL and symptoms of depression

QoL and symptoms of depression were analysed depending on the type of implanted device. MCS was significantly higher in patients with HM than those with HW ($p < 0.05$).

QoL and type of social support among patients and caregivers

PCS correlates significantly ($p < 0.05$) and negatively ($r > 0$) with currently received information support; higher PCS indicates lower information support. MCS correlates significantly ($p < 0.05$) and positively ($r > 0$) with perceived emotional and instrumental support, indicating that higher MCS corresponds to greater emotional and instrumental support in patients. For caregivers, PCS correlates significantly ($p < 0.05$) and positively ($r > 0$) with currently provided instrumental support, indicating that higher PCS leads to more instrumental support. MCS correlates significantly ($p < 0.05$) and positively ($r > 0$) with protective buffering support, indicating that higher MCS results in greater protective buffering. MCS correlates significantly ($p < 0.05$) and negatively ($r > 0$) with perceived

Table 2. Quality of life, social support, and symptoms of depression and anxiety

Parameter	Group	*N*	Median	Min.	Max.	Q1	Q3	*P*-value
Perceived emotional support	Patients	54	3.50	1.00	4.00	3.00	4.00	0.946
	Caregivers	53	3.50	2.00	4.00	3.00	4.00	
Perceived instrumental support	Patients	54	3.62	2.00	4.00	3.00	4.00	< 0.001*
	Caregivers	53	2.33	0.83	2.67	2.00	2.67	
Need for support	Patients	54	3.25	1.75	4.00	2.75	3.50	< 0.001*
	Caregivers	53	1.20	0.40	1.60	1.10	1.30	
Support seeking	Patients	54	3.00	1.60	4.00	2.65	3.60	< 0.001*
	Caregivers	53	1.00	0.33	1.33	0.87	1.20	
Protective buffering support	Patients	54	3.00	1.00	4.00	2.37	3.33	0.467
	Caregivers	54	3.00	1.00	4.00	2.66	3.34	
Anxiety	Patients	54	5.00	0.00	21.00	3.00	7.00	< 0.001*
	Caregivers	54	0.00	0.00	10.00	0.00	1.00	
Depression	Patients	54	4.00	0.00	10.00	2.00	7.00	< 0.001*
	Caregivers	54	0.00	0.00	7.00	0.00	0.00	
Irritability	Patients	54	2.00	0.00	6.00	2.00	2.75	< 0.001*
	Caregivers	54	0.00	0.00	4.00	0.00	2.00	
PCS	Patients	54	41.87	28.19	57.10	37.18	45.29	< 0.001*
	Caregivers	54	55.94	35.38	62.75	51.75	57.62	
MCS	Patients	54	45.58	33.35	64.27	41.21	50.06	0.008*
	Caregivers	54	48.98	29.88	62.48	43.88	57.47	

*p – Mann-Whitney test, SD – standard deviation, Q1 – lower quartile, Q3 – upper quartile. *Statistically significant relationship (p < 0.05).*

instrumental support, indicating that higher MCS is associated with lower perceived instrumental support.

Quality of life predictors

PCS in patients

The multivariate linear regression model showed that PCS increased by an average of 1.6 points yearly after LVAD implantation (Table 3).

MCS in patients

The multivariate linear regression model showed MCS reduced by an average of 0.64 points for each point on the depression scale (regression parameter is –0.64). The HW device lowers MCS by an average of 4.96 points (*t* regression parameter is –4.96) compared to the HM device (Table 4).

PCS and MCS in caregivers

The multivariate linear regression model showed that each additional year of life reduces PCS by an average of 0.16 points, and PCS increases yearly after LVAD implantation by an average of 1.18 points. Professional activity increases MCS by an average of 6.86 points; after LVAD implantation, MCS is reduced by an average of 1.45 points yearly.

Discussion

The study provides the first data on the experience of depressive symptoms, QoL, and social support of patients and caregivers of patients with LVAD in Poland.

The study found depression and anxiety symptoms to reduce patients' mental QoL and influence the choice of social support. The symptoms lowered perceived instrumental and protective buffering support. In caregivers, higher anxiety levels increased the need for protective buffering support while reducing perceived instrumental support. Patients' QoL predictors have included time since LVAD implantation, which enhanced physical QoL but decreased mental QoL. Depression and device type (HW) lowered mental QoL; among caregivers, years of life reduced physical QoL, while it increased yearly post-implantation. Professional activity boosted mental QoL but decreased yearly post-LVAD implantation.

INTERMACS Registry results showed that nearly one-third of patients died or had a persistently poor QoL during the year after LVAD [15]. Modica *et al.*

Table 3. Multivariate linear regression for PCS in patients

Symptom	Parameter	95% CI		*P*-value
Anxiety	0.118	–0.412	0.649	0.664
Depression	–0.556	–1.255	0.142	0.125
Age				
[years]	–0.054	–0.235	0.128	0.565
Type of LVAD				
HM	ref.			
HW	–1.555	–6.145	3.036	0.51
Duration of LVAD support				
[years]	1.6	0.497	2.702	0.007*

*p – multivariate linear regression. *Statistically significant relationship (p < 0.05).*

Table 4. Multivariate linear regression for MCS in patients

Symptom	Parameter	95% CI		*P*-value
Anxiety	–0.234	–0.695	0.227	0.324
Depression	–0.645	–1.252	–0.039	0.042*
Age				
[years]	0.102	–0.055	0.26	0.21
Type of LVAD				
HM	ref.			
HW	–4.961	–8.948	–0.975	0.018*
Duration of LVAD support				
[years]	–0.65	–1.607	0.308	0.19

*p – multivariate linear regression. *Statistically significant relationship (p < 0.05).*

found that early postimplant findings showed constantly lower PCS than the ordinary population [16]. Our study's PCS and MCS scores were also lower than those of the general population, but the patients had better results in both QoL components. Patients had low scores in general health and high rates of bodily pain. Comparing the QoL of patients with LVAD and HF, Schmalz *et al.* found that PCS was 34.9 ±8.8 and MCS was 48.8 ±12.6 among LVAD patients [17]. Their PCS scale results were higher, and their MCS results were lower than ours. Suzuki *et al.* showed that patients rated PCS very low at 37.7 (29.1–49.9) and MCS high at 48.6 56.9 (52.4–64.5) [18]. Our study did not confirm this data. Kirkpatrick *et al.* explored the burdens and QoL of caregivers of patients with LVAD-destination therapy. They found that the psychological component had the lowest average QoL score, followed by the social, spiritual, and physical subscales. The mean QoL scores were highest among the caregivers aged < 40 and ≥ 70 years [7]. In our study, we did not observe an association with age. Kato *et al.* showed no statistically significant modification in caregivers' PCS scores during the distant observation (before 52.7 ±7.1; at 3 months, 49.7 ±6.5; at 6 months, 50.7 ±6.4, n = 20) [5]. In our study, caregivers' MCS were similar (48.98), and the scores were lower than in the general population (norm = 50), but this domain decreased yearly post-LVAD implantation. In our study, we saw no symptoms of depression and anxiety. Modica *et al.* found that 50% of the patients had HADS scores indicated for both depression and anxiety [19]. Jesus *et al.* showed that depression was a stronger predictor of QoL than anxiety [20]. In our study, depression was a QoL predictor for patients in the MCS domain. A candidate for LVAD implantation should live with a caregiver. Family, social, and emotional support must be evaluated before LVAD therapy [21]. No study has comprehensively assessed social support needs among LVAD recipients and caregivers. Our research found that perceived social support was greater among patients, while perceived emotional support was more pronounced among care-

givers. Patients reported significantly higher levels of perceived instrumental support and a greater need for support than caregivers. Support-seeking was also higher among patients. We identified relationships between QoL, depression, anxiety, and social support; specifically, the availability of a systematic review shows that support from family and friends greatly enhances HRQoL for LVAD patients [22]. Spielmann *et al*. found that most patients reported average to high perceived social support. Higher perceived social support was associated with lower levels of anxiety and depression and higher levels of QoL [23]. In our study, perceived instrumental support alone was positively associated with anxiety and depression. The mental domain of QoL correlated significantly and positively with perceived emotional support and perceived instrumental support. In our study, the time since LVAD implantation and the type of support received predicted QoL. The type of device used influenced patients' QoL with MCS significantly more in those with HM than in those with HW. Comparative studies indicate that HW devices have a higher incidence of strokes and are an independent risk factor [24]. In 2021, the company ceased distribution and sale of the HW System.

The study's limitations include several factors. First, as a single-centre study, the results may only reflect this centre's effectiveness in enhancing caregivers' QoL, limiting their applicability to the LVAD population in other centres. Second, the convenience sampling technique may have introduced bias that a randomised selection could have avoided; more burdened caregivers might have been excluded from the study due to their perception of excessive burden.

Conclusions

QoL after LVAD implantation improves in the physical domain but worsens in the mental domain, influenced by depression symptoms and support device type. Caregivers' physical QoL life decreases yearly and increases yearly post-implantation. In the mental domain, professional activity predicts improvement, whereas each year after LVAD implantation reduces this domain. Strategies monitoring QoL and depression are essential for managing patients enduring long-term support or facing unpleasant symptoms from support-related complications. Strengthening the social support system is crucial to enhance patients' and caregivers' roles and activities post-discharge.

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Ethical approval

Approval number: KBKA/23/O/2021.

Conflict of interest

The authors declare no conflict of interest.

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