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Retrospective evaluation of the effect of nutritional status of patients with left ventricular assist device on clinical results in the postoperative period

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ABSTRACT

Objective: Malnutrition in patients undergoing left ventricular assist device (LVAD) implantation has negative consequences, such as infection and limited functional capacity. The effects of nutritional status of patients with LVAD on their clinical outcomes were investigated.

Methods: Patients with LVAD implantation were retrospectively analyzed. For nutritional evaluation, nutrition risk score NRI score was calculated to divide the patients first into two groups with and without malnutrition risk (MR) then three subgroups (mild/moderate/severe) according to malnutrition risk. Demographic and clinical data before LVAD, early postoperative adverse events after LVAD, prognostic data, and laboratory findings were analyzed.

Results: Sixty patients (9 females) had a mean age of 46.1±14.3 years; mean NRI score was 99.6±10.2. Interagency Registry for Mechanically Assited Circulatory Support (INTERMACS) scores were determined as 1 (n=10), 2 (n=18), 3 (n=11), and 4 (n=21). Thirty-two patients (53.3%) (6 mild, 25 moderate, 1 severe) had MR. The MR was higher in patients with preoperative INTERMACS score 1, acute renal injury (AKI), emergency LVAD indication, mechanical ventilation (MV) and preoperative ICU requirement. The incidence of adverse events was found to be significantly higher in patients with low-grade NRI and early postoperative MR. Postoperatively, the duration of renal replacement therapy (RRT), MV, ICU and hospital stay and the need for heart transplantation and mortality did not differ between the two groups.

Conclusion: In the early postoperative period, a MR of 53.3% was detected in patients who underwent LVAD. Total 68.8% patients had adverse events. We found that the presence of MR was effective in predicting postoperative adverse events according to NRI score before LVAD treatment.

Keywords: Intensive care unit, left ventricular assist device treatment, malnutrition risk, NRI scoring system

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Introduction

Left ventricular assist device (LVAD) implantation is successfully applied all over the world and in our country for the treatment of end-stage heart failure with an aim to bridge decision making, bridge to candidacy, bridge to transplantation (BTT), and long-term destination therapy (DT) (1, 2). The assessment and support of nutrition is an integral part of LVAD treatment. Nutrition disorder and cardiac cachexia contribute toward a series of postoperative problems that have long-term negative effects such as infection and limited functional capacity (3-5). Therefore, body mass index (BMI) has become an important determinant of cardiac results in the selection of patients under LVAD implantation application.

Mortality in chronic heart failure patients is in close relation with classic markers such as BMI and albumin values. However, the reliabilities of both these parameters are insufficient when evaluated individually since they can be influenced by inflammation, fluid loading, hepatic impairment, kidney problems, and changes in blood volume (6). While the indirect calorimetry method is used for the detection of energy consumption

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of patients under LVAD therapy, bedside malnutrition risk evaluation is assisted by risk scoring systems, such as ESPEN-NRS 2002 and nutritional risk index (NRI).

In patients under LVAD treatment, NRI-a practical and fast applied nutrition evaluation tool-has been used during patients' application to cardiovascular surgery polyclinics and intensive care units. When technical equipment is present, the use of indirect calorimetric measurement methods for the detection of energy consumption measurement in daily applications has been suggested in patients with high malnutrition risk (7).

In our study, we aimed to evaluate the retrospective effects of nutrition on the clinical results in LVAD-applied patients during the early postoperative period using NRI.

Methods

After the approval from the Ethics Committee of Baskent University Medicine Faculty September 25, 2018 (KA18/278), patients accepted postoperatively after LVAD implantation in the cardiovascularw surgery's intensive care unit were included in this retrospective study. In order to calculate the NRI scores, patients with insufficient data on serum albumin and body weight were excluded.

The patients were divided into two groups: as malnutrition risk present (MRP) (NRI≤99) and no malnutrition risk (NMR) (NRI≥100) according to their NRI scores. In the next step, the MRP group was subdivided into three groups: severe (NRI<83.5), moderate (83.5≤NRI<97.5), and mild (97.5≤ NRI<100) according to their NRI scores.

The BMI (kg/m^2) values of the patients under investigation were calculated using their heights and weights.

The demographic data, including age, gender, height, current weight, BMI, ideal body weight (IBW), and maximum-minimum and average NRI scores, were recorded.

Clinical data prior to LVAD therapy, namely, the indication of LVAD treatment, bridge to decision making, bridge to candidacy, bridge to transplantation (BTT), long-term therapy (destination therapy (DT)), associated diseases (ischemic heart disease, hypertension, chronic obstructive pulmonary disease (COPD), diabetes mellitus, acute kidney injury (AKI), chronic kidney injury (CKI), and thyroid diseases), number of patients and their values in percentage, and Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) scoring system values for the scoring of cardiac impairment, were evaluated. Preoperative LVAD therapy urgency, needs for dialysis, intensive care, mechanical ventilator and dobutamine, values of tricuspid annular plane systolic excursion (TAPSE), left ventricular ejection fraction (EF, %), and pulmonary artery pressure (PAP) using transthoracic echocardiography were examined.

All these data were categorized into two groups: MRP and NMR. Adverse events after LVAD treatment (SVDC thrombus, wound debridement, AV groove rupture, tamponade, intracranial hemorrhage, arrest, and hemorrhages in all the other bodily regions except RVR, RVDC, RVAD requirement, and sepsis) were retrospectively analyzed and compared between the groups. The distribution of the prognostic clinical finding and comparison between the groups were studied after LVAD therapy.

In the biochemical tests performed in the biochemistry laboratory, creatinine, blood urea nitrogen (BUN), and albumin values on the preoperative and postoperative days 2 and 7 were evaluated. Their values between and within the MRP and NMR groups were analyzed.

Statistical analysis

Number Cruncher Statistical System (NCSS) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. During data evaluation, besides the descriptive statistical methods (average, standard deviation, median, frequency, ratio, minimum, and maximum), the quantitative data of the two groups showing normal distribution were compared using the Student's t-test, while the Mann-Whitney U-test was used for data without normal distribution. Pearson's chi-squared test, Fisher-Freeman-Halton exact test, and Fisher's exact test were used for comparing the qualitative data. The follow-up of the variable without normal distribution was performed with the Friedman test, and Wilcoxon signed-rank test was used for the evaluation of the paired comparison. The in-group evaluation of data with normal distribution was performed with paired sample T-test. The significance was evaluated at p<0.05.

Results

A total of 60 cases, 51 M (85%) and 9 F (15%), with ages varying between 9 and 73 years, who were accepted to the intensive care unit after LVAD application, were included in this study. The age of the patients was 46.1±14.3 years; BMI was 24.9±4.9 kg/m^2; IBW was 64.4±6.8 kg. The distribution of clinical data before LVAD treatment is shown in Table 1.

The average NRI score in the patients was calculated to be 99.6±10.2. According to the NRI scoring system, a score of 32 (53.3%) shows the risk for malnutrition. Malnutrition risks were classified as mild, moderate, and severe in 6 (10%), 25 (41.6%), and 1 (1.7%) cases, respectively (Table 2).

Table 1. Data distribution before LVAD treatment

Data before LVAD treatment		n (%)
LVAD treatment indications	DT	31 (51.7)
	BTT	23 (38.3)
	Bridge to candidacy	2 (3.3)
	Bridge to decision making	4 (6.7)
Associated diseases	Ischemic heart disease	27 (45.0)
	AKI	7 (11.7)
	CKI	3 (5.0)
	Diabetius Mellitus	20 (33.3)
	Hypertension	22 (36.7)
	COPD	12 (20.0)
	Thyroid diseases	8 (13.3)
INTERMACS Scores	Score 1	10 (16.6)
	Score 2	18 (30)
	Score 3	11 (18.3)
	Score 4	21 (35)
The presence of urgent need for LVAD treatment		14 (23.3)
Need of dialysis		12 (20.0)
Need of intensive care		36 (60.0)
Need of mechanical ventilation		5 (8.3)
Need of dobutamine		27 (45.0)
TAPSE (mm)	Min-Max (Median)	8-25 (13)
	Mean±SD	13.6±3.8
EF (%)	Min-Max (Median)	8-55 (18)
	Mean±SD	18.8±6.4
PAP (mmHg)	Min-Max (Median)	25-90 (55)
	Mean±SD	55.0±12.7

LVAD: left ventricular assist device; DT: destination therapy; BTT: bridge to transplantation; AKI: acute kidney injury; CKI: chronic kidney injury; COPD: chronic obstructive pulmonary disease; INTERMACS: Interagency Registry for Mechanically Assisted Circulatory Support Scoring; TAPSE: tricuspid annular plane systolic excursion; EF: ejection fraction; PAP: pulmonary artery pressure; SD: standard deviation

A statistically significant difference was not detected between the ages of the patients in the presence of malnutrition (p>0.05). The frequency of malnutrition is higher in female patients (p=0.029). BMI values were lower in the MRP group in the presence of malnutrition (p=0.001). IBW measurements were similar in the MRP and NMR groups (p>0.05). Patients with MRP have lower NRI values (p=0.001) (Table 3).

Left ventricular assist device therapy indications do not exhibit a significant difference between the two groups (p>0.05). In the MRP group, while the frequencies of ischemic heart disease, CKI, diabetes mellitus, hypertension, COPD, and thyroid disease do not show a statistically significant difference, the elevated level of the AKI frequency was found to be statistically significant (p=0.012) (Table 4).

When the INTERMACS scores were 2, 3, and 4, no significant relation existed with the malnutrition frequency; MRP was statistically more common in patients with INTERMACS score of 1 (p=0.001). Patients with urgent LVAD therapy indications had statistically high MRP scores (n=11, 34.4%) (p=0.0). Between the groups, the patients with the need of dialysis and dobutamine support did not show a statistically significant difference (p>0.05). A statistically significant difference between the two groups was detected in terms of the intensive care unit ratios (p=0.011): patients with MRP had higher ratios (n=24, 75%). Further, a statistically significant difference was observed between the groups when the need for mechanical ventilation support prior to LVAD therapy was considered (p=0.029): the MRP group is in additional need of mechanical ventilation support (n=5, 15.6%) (Table 4).

After LVAD treatment, during CVS intensive care unit follow-up, adverse events were not observed in 43.3% (n=26) cases, while they were present in 56.7% (n=34) cases. Depending on the presence of malnutrition, the occurrence of adverse events after LVAD treatment shows statistically significant difference between the groups (p=0.043); adverse events after LVAD treatment are more frequent in the MRP groups (n=22, 68.8%). The need for dialysis (RRT), mortality, and heart transplantation therapy after LVAD treatment do not show a statistically significant difference between the two groups (MRV/MRY) (p>0.05). Depending on the presence of malnutrition, the duration at the intensive care unit, hospitalization, and mechanical ventilation support do not show a statistically significant difference between the two groups (p>0.05) (Table 5).

Depending on the presence of malnutrition, creatinine values on preoperative day (creatinine 1), postoperative day 2 (creatinine 2), and postoperative day 7 (creatinine 3) do not show a statistically significant difference (p>0.05). In the

NMR group, changes in the creatinine 1, 2, and 3 measurements were statistically significant (p=0.001). Comparative analyses have shown that there was an increase in creatinine at the second measurement as compared to that at the first measurement (p=0.013); there was a decrease in creatinine in the third measurement as compared to that at the first measurement (p=0.010); and there was a decrease in creatinine in the third measurement as compared to that at the second measurement (p=0.001); these were statistically significant (p<0.05) (Table 6). In the case of the MRP group, the preoperative (Albumin1) and postoperative (Albumin2) albumin values were significantly lower than those in the NMR group (p=0.001 and p=0.047, respectively). Further, the postoperative albumin values were statistically significantly and lower than the preoperative albumin values in the MRP cases (p=0.001) (Table 6).

Table 2. Classification of patients according to their malnutrition status using NRI scoring system

	n (%)
Malnutrition risk	
Absent (NMR)	28 (46.7)
Present (MRP)	32 (53.3)
MRP	
Mild	6 (10.0)
Moderate	25 (41.6)
Severe	1 (1.7)

MRP: presence of malnutrition risk; NMR: absence of malnutrition risk

Discussion

In this study, where the effects of the nutritional status in the LVAD during the early postoperative period were retrospectively evaluated using the NRI scores, the presence of malnutrition was detected in 53.3% cases in the early postoperative period. Patients who have AKI before LVAD treatment with an INTERMACS score of 1 and with urgent LVAD treatment indication and who are in need of treatment in the intensive care unit during the preoperative period have higher risks for malnutrition. When patients with higher risks for malnutrition were compared to those without such risks, 68.8% patients

Table 3. Evaluation of malnutrition risk according to demographic properties

	Malnutrition risk		
Demographic properties	**Absent (n=28) n (%)**	**Present (n=32) n (%)**	**p**
Age (year)			
Min-Max (Median)	31-68 (50.5)	9-73 (43.5)	[a]0.059
Mean±SD	49.7±9.1	43.0±17.2	
Gender			
Male	27 (96.4)	24 (75.0)	[b]0.029*
Female	1 (3.6)	8 (25.0)	
BMI (kg/m²)			
Min-Max (Median)	20.4-36.5 (27.9)	13-31.8 (23)	[a]0.001**
Mean±SD	27.6±4.3	22.6±4.3	
IBW (kg)			
Min-Max (Median)	53-76.3 (65)	41-74 (65)	[a]0.243
Mean±SD	65.6±5.7	63.5±7.7	
NRI			
Min-Max (Median)	98.8-131.1 (105.4)	83.3-100 (92.8)	[a]0.001**
Mean±SD	108.2±7.6	92.1±5.0	

[a]Student's t-test, [b]Fisher's exact test, *p<0.05, **p<0.01. BKI: body mass index; IBW: ideal body weight; NRI: nutritional risk index; SD: standard deviation

Table 4. Comparison of clinical data before LVAD treatment in the presence of malnutrition

Clinical data before LVAD treatment	Malnutrition		p
	Absent (n=28) n (%)	Present (n=32) n (%)	
LVAD treatment indications			
DT	17 (60.7)	14 (43.8)	d0.123
BTT	11 (39.3)	12 (37.5)	
Bridge to candidacy	0 (0)	2 (6.3)	
Bridge to decision making	0 (0)	4 (12.5)	
• Associated diseases			
Ischemic heart disease	15 (53.6)	12 (37.5)	c0.212
AKI	0 (0)	7 (21.9)	b0.012*
CKI	2 (7.1)	1 (3.1)	b0.594
Diabetes mellitus	12 (42.9)	8 (25)	c0.143
Hypertension	11 (39.3)	11 (34.4)	c0.694
COPD	5 (17.9)	7 (21.9)	c0.698
Thyroid diseases	2 (7.1)	6 (18.8)	b0.264
INTERMACS			
Score 1	0 (0)	10 (31.3)	b0.001**
Score 2	11 (39.3)	7 (21.9)	c0.142
Score 3	4 (14.3)	7 (21.9)	c0.448
Score 4	13 (46.4)	8 (25.0)	c0.083
The urgent need for LVAD treatment			
Absent	25 (89.3)	21 (65.6)	c0.031*
Present	3 (10)	11 (34.4)	
Need of dialysis			
Absent	24 (85.7)	24 (75.0)	c0.301
Present	4 (14.3)	8 (25.0)	
Need of intensive care			
Absent	16 (57.1)	8 (25.0)	c0.011*
Present	12 (42.9)	24 (75.0)	
Need of mechanical ventilation			
Absent	28 (100)	27 (84.4)	c0.029*
Present	0 (0)	5 (15.6)	
Need of dobutamine			
Absent	17 (60.7)	16 (50)	c0.405
Present	11 (39.3)	16 (50)	
TAPSE (mm)			
Min-Max (Median)	8-19 (14)	8-25 (12)	a0.343
Mean±SD	14.1±3.1	13.1±4.4	
EF (%)			
Min-Max (Median)	10-25 (18)	8-55 (18)	a0.564
Mean±SD	18.3±4.3	19.2±7.9	
PAP (mmHg)			
Min-Max (Median)	30-75 (52.5)	25-90 (55)	a0.184
Mean±SD	52.6±12.0	57.0±13.1	

•More than one disease is observed. aStudent's t-test, bFisher's exact test, cPearson's chi-squared test, dFisher-Freeman-Halton exact test, eMann-Whitney U test, *p<0.05. LVAD: left ventricular assist device; DT: destination therapy; BTT: bridge to transplantation; AKI: acute kidney injury; CKI: chronic kidney injury; COPD: chronic obstructive pulmonary disease; INTERMACS: Interagency Registry for Mechanically Assisted Circulatory Support Scoring; TAPSE: tricuspid annular plane systolic excursion; EF: ejection fraction; PAP: pulmonary artery pressure; SD: standard deviation

Table 5. Adverse events after LVAD treatment in the presence of malnutrition and evaluation of prognosis features			
	Malnutrition		
Adverse events after LVAD treatment	Absent (n=28) n (%)	Present (n=32) n (%)	p
Absent	16 (57.1)	10 (31.3)	[c]0.043*
Present	12 (42.9)	22 (68.8)	
LVAD trombus	1 (3.6)	5 (15.6)	
Wound debridement	3 (10.7)	6 (18.8)	
AV Groove rupture	0 (0)	1 (3.1)	
Cardiac tamponade	0 (0)	1 (3.1)	
Intracranial hemorrhage	0 (0)	1 (3.1)	
Arrest	1 (3.6)	2 (6.3)	
hemorrhage (other)	2 (7.1)	3 (9.4)	
RVDC RVAD	0 (0)	1 (3.1)	
Sepsis	4 (14.3)	1 (3.1)	
Wound debridement+Intracranial hemorrhage	0 (0)	1 (3.1)	
Cardiac tamponade+ Intracranial hemorrhage	1 (36)	0 (0)	
Prognosis after LVAD treatment			
Need for dialysis (RRT)			
Absent	21 (75.0)	22 (68.8)	[c]0.592
Present	7 (25.0)	10 (31.3)	
Duration at ICU (day)			
Min-Max (Median)	4-95 (11)	1-82 (16.5)	[e]0.161
Mean±SD	18.9±21.2	22,8±19,2	
Hospitalization duration (day)			
Min-Max (Median)	6-98 (30)	2-155 (36.5)	[e]0.150
Mean±SD	33.8±21.6	46.0±36.1	
Mechanical ventilation duration (hour)			
Min-Max (Median)	10-564 (24)	5-600 (40.5)	[e]0.265
Mean±SD	59.2±105.9	75.6±116.7	
Mortality			
Absent	18 (64.3)	16 (50.0)	[c]0.235
Present	10 (35.7)	16 (50.0)	
Heart Tx after LVAD treatment			
Absent	25 (89.3)	27 (84.4)	[b]0.712
Present	3 (10.7)	5 (15.6)	

[b]Fisher's exact test, [c]Pearson's chi-squared test, [e]Mann-Whitney U test, *p<0.05.

LVAD: left ventricular assist device; AV: atrioventricular; RVDC RVAD: Right ventricular assist device; ICU: Intensive care unit; RRT: renal replacement theraphy; SD: standard deviation

Table 6. Evaluation of creatinine, BUN, and albumin in follow-ups in the presence of malnutrition

	Malnutrition		p
	Absent (n=28)	Present (n=32)	
Creatinine1			
Min-Max (Median)	0.6-3.9 (1)	0.6-3.2 (0.8)	0.073
Mean±SD	1.2±0.6	1.0±0.6	
Creatinine2			
Min-Max (Median)	0.6-4.8 (1.2)	0.5-3.4 (1.2)	0.084
Mean±SD	1.5±0.9	1.5±0.8	
Creatinine3			
Min-Max (Median)	0.5-4.6 (0.8)	0.4-3.8 (0.7)	0.700
Mean±SD	1.0±0.8	1.1±0.8	
[f]p	0.001**	0.001**	
[g]C1-C2	0.013*	0.001**	
[g]C1-C3	0.010*	0.388	
[g]C2-C3	0.001**	0.001**	
BUN1			
Min-Max (Median)	10-68.9 (20.5)	10-110 (22.7)	0.882
Mean±SD	27.2±16.3	26.7±18.6	
BUN2			
Min-Max (Median)	13-78.3 (28,3)	12-100 (40.5)	0.063
Mean±SD	33.1±16.8	42,1±20,9	
BUN3			
Min-Max (Median)	9-79.7 (20)	6-56 (19.1)	0.558
Mean±SD	28.7±20.4	23.6±13.7	
[f]p	0.002**	0.001**	
[g]B1-B2	0.004**	0.001**	
[g]B1-B3	0.639	0.507	
[g]B2-B3	0.060	0.001**	
Albumin1			
Min-Max (Median)	26-42 (38)	25-40,2 (32,9)	[a]0.001**
Mean±SD	37.5±4.0	32.9±4.1	
Albumin2			
Min-Max (Median)	25-39 (33)	24-38.7 (31)	[a]0.047*
Mean±SD	33±3.6	31±3.9	
[h]p	0.001**	0.004**	

[a]Student's t-test, *p<0.05, **p<0.01, [f]Friedman test, [g]Wilcoxon signed-rank test, [h]paired sample t-test.
Creatinine1: Preoperative creatinine; Creatinine2: Postoperative day 2 creatinine; Creatinine3: Postoperative day 7 creatinine; BUN1: Preoperative blood urea nitrogen; BUN2: Postoperative day 2 blood urea nitrogen; BUN3: Postoperative day 7 blood urea nitrogen; Albumin1: Preoperative albumin; Albumin2: Postoperative albumin; SD: standard deviation

that exhibited adverse events, need for renal replacement therapy, mortality, heart transplantation, intensive care unit and hospitalization needs, as well as mechanical ventilation duration did not show a statistically significant difference.

Today, survival has reached up to 80% with long-term LVAD treatment (8). For success and survival, patients who benefit with high probability from this treatment should be carefully selected. The one-year survival ratio of advanced-stage cardiac failure has been stated as 80% in cases with INTERMACS scores of 2 and 3 (9, 10). Uribarri et al. (11) retrospectively analyzed 279 patients in terms of the malnutrition risk using NRI scoring with three groups (severe, moderate, and mild); the one-year survival ratios after LVAD treatment were determined to be 53.3%, 31.7%, and 23.1%, respectively. In the same study, while patients with mild malnutrition according to NRI scoring were more prevalent in the group with the INTERMACS score of 1 (n=7, 26.9%), the number of cases with severe malnutrition was high in the group with INTERMACS score of 2 (n=3, 20%). The NRI scoring system was discovered by the Veterans Affairs Total Parenteral Nutrition Cooperative Study Group that could be used during the preoperative period; it is reported to be a simple and reliable method for the inhibition of complications that might occur as a result of malnutrition after LVAD treatment (7, 12). In our study, malnutrition was detected in all the patients with an INTERMACS score of 1. There was no difference in the presence of malnutrition in the patient groups with INTERMACS scores of 2, 3, and 4. In our research, although we initially subcategorized the MRP group into three (mild, moderate, and severe), since only one patient was detected in the severe malnutrition group, comparisons were performed for two groups, namely, MRP and NMR. Eduardo Barge-Caballero et al. (7) showed that low scores in the NRI system are related to increased mortality, longer hospitalization durations, and hospitalization; since isolated criteria are used during the estimation of the malnutrition risk, it might have limitations in the reflection of nutrition status after heart transplantation. In our study, mechanical ventilation duration, mortality, and intensive care unit and hospitalization durations of patients with 53.3% malnutrition risk according to the NRI scores did not show a significant difference as compared to the NMR group, which is in contrast to the findings of Aziz et al. (12). The presence of malnutrition in our study was significantly higher in females as compared to males. These results may be attributed to the limited number of cases and this being a single-centered study.

In our study, while BMI is low in patients with malnutrition, there was no significant difference in the terms of IBW between the MRP and NMR groups. Al-Najjar and Clark (13) stated that calculating the BMI is easy in patients with advanced heart failure, but it is difficult to associate it with prognosis since mortality and VKA have a “U-shaped” relation. Meanwhile, Cowger et al. (14) emphasized that a low albumin level is an important indicator in the prediction of mortality. We have also detected that albumin levels in the MRP group during both preoperative and postoperative periods are significantly lower as compared to those in the NMR group. Critsinelis et al. (15) showed that the prealbumin levels are more specific and sensitive in the evaluation of protein malnutrition as compared to albumin, but the prealbumin concentration can be rapidly influenced by infections and inflammations, since it is an acute-phase reactant. One of the limitations of our study is the inability to retrospectively obtain the prealbumin levels of all the patients.

Thomas et al. (16) stated that deficits in malnutrition delay wound healing due to an impaired immune system, increase in postoperative complication ratios, and local and systemic infection risks. The same authors emphasized that the ideal time for the evaluation of nutrition in patients who are taken to an elective operation is from the first application to the hospital. In our study, in the MRP group, both the need for urgent LVAD and some adverse events occurring after LVAD have been found to be significantly higher. In our study series, the need for mechanical ventilation was found to be higher in the MRP than the NMR group before LVAD treatment.

Sandner et al. (17) found that in an 86-case cohort under continuous current LVAD treatment, mortality was increased in patients with AKI as compared to individuals with normal kidney functions. Meanwhile, the ratio of these AKI patients in need of cardiac transplantation is lower (18, 19). In our study, while no significant difference was observed in the occurring frequencies of ischemic heart disease, CKI, diabetes mellitus, hypertension, COPD, and thyroid diseases between the MRP and NMR groups, the AKI frequency was significantly higher in the MRP group. There was no significant difference between the groups in terms of the need for RRT after LVAD treatment.

Among the limitations of our study, being retrospective, single-centered, using a single parameter in the evaluation of nutritional status, and numerical imbalance between the groups due to a large patient cohort can be considered.

In our study, according to the NRI scores, the malnutrition risk during the postoperative period was shown to be present in one out of two patients who were subjected to LVAD. The early- and late-period complication frequencies were found to be higher in patients with malnutrition risks. Considering these data, we believe that patients with planned LVAD treatment should be evaluated with easily applicable and effective tests (e.g., NRI scoring system) to determine detailed nutrition at the initial arrival to the hospital and nutrition support should be initiated according to these results.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Baskent University School of Medicine (No: 25, Date: 2018).

Informed Consent: Due to the retrospective design of the study, informed consent was not taken.

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