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Factors Delaying the Progress of Early Rehabilitation of Elderly Japanese Patients with Heart Failure

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Keywords: Heart failure, Elderly Japanese patients, Early rehabilitation, Factors in delaying progress

Abstract

Background: Although intervention with early cardiac rehabilitation (CR) is recommended for elderly patients treated for acute heart failure (HF), there are patients in whom the progress of early CR will be delayed. The aim of this study was to clarify factors related to the progress of early CR.

Methods: We enrolled 180 Japanese inpatients aged ≥65 years with HF in the present retrospective cohort study. We set a short-term goal of 30 m of walking at one week after the start of early CR. We divided the patients into two groups according to whether this goal was achieved (Achievement group, n=124) or not (Non-achievement group, n=56) and compared patients' characteristics and clinical parameters.

Results: There was a significant difference (p <0.05) between the groups for age, length of hospital stay, Functional Independence Measure at discharge, walking level before hospitalization, rate of co-existence of diabetes mellitus, chronic renal failure, orthopedic disease, use of diuretics, creatinine, Prognostic Nutritional Index, hemoglobin, C-reactive protein, and estimated glomerular filtration rate (eGFR). Furthermore, logistic regression analysis showed that walking level before hospitalization (odds ratio [OR]: 3.144, p=0.0001) and eGFR (OR: 0.971, p = 0.009) were factors related to the inability to achieve the short-term goal.

Conclusion: Our findings suggest that walking level before hospitalization and renal function on admission are factors related to delayed progress in early CR of elderly Japanese patients with HF.

Keywords: Heart failure, Elderly Japanese patients, Early rehabilitation, Factors in delaying progress

Background

Japan is the world's oldest aging society in terms of average lifespan and rates and speed of aging [1,2] and is currently dealing with a super-aging society that the world has never experienced before [3]. The percentage of elderly people aged 80 years or older who are hospitalized with heart failure (HF) is about 37% [4], and in clinical practice, the number of elderly HF patients with comorbid diseases is increasing [5,6].

In patients with HF, because treatment is performed with rest until the circulatory dynamics are corrected, the patient's physical condition tends to be exacerbated [7]. Especially in elderly patients, physical deconditioning progresses remarkably when they are hospitalized, walking ability declines, and difficulty with activities of daily living (ADL) increases [8]. Early cardiac rehabilitation (CR) is recommended in the acute HF guidelines of the Japan Cardiovascular Society and the European Society of Cardiology. However, the progress of some patients participating in early CR will be delayed.

Previous studies have reported that ADL and the physical function of elderly HF patients before hospitalization are risk factors for the acquisition of ambulation [9]. Walking level and estimated glomerular filtration rate (eGFR) are strong predictors of prognosis [10,11]. Furthermore, a factor affecting ADL, physical function, and exercise tolerability was reported to be the combination of reduced renal function and anemia [12–14], and malnutrition [15–18] has also been reported. In addition, the presence of complications is related to the patient's return to home [19].

Therefore, we hypothesized that the factors related to a delay in the progression of rehabilitation in terms of early ambulation acquisition would be renal function before

hospitalization, anemia, walking level, comorbidities, malnutrition, and time from hospital admission to CR initiation. The aim of present study was to clarify the factors related to the acquisition of early ambulation in elderly Japanese patients with HF undergoing early CR.

Methods

Study design and participants

We included in this retrospective cohort study 350 consecutive patients hospitalized for HF who underwent CR in the cardiovascular internal medicine ward at Yodogawa Christian Hospital, Osaka, Japan between January to June 2016. CR was performed while the patient was sitting in a chair at the bedside. Exclusion criteria included aged under 65 years old, inability to walk 30 m before hospitalization, refusal to participate in CR, infection acquired prior to or during hospitalization, renal dialysis, and death within one week of the start of CR. The main outcome of this study was patient characteristic factors related to the achievement of the short-term goal as defined in section 2.4. Patient characteristics were evaluated by review of the medical records, and comparisons were made between the target achievement group and non-achievement group.

Ethics

The protocol of this study was approved by the institutional review board for ethics at Yodogawa Christian Hospital (approval no. 2017-095). Informed consent was obtained from each patient.

Investigation

Patients' characteristics and clinical parameters evaluated included age, sex, body mass index (BMI), walking level before hospitalization, comorbidities, number of hospitalizations for HF, initiation day of CR, Functional Independence Measure (FIM) at the times of hospitalization and discharge, systolic blood pressure, oxygen dose, length of hospital stay, hospital-phase medications, and the presence or absence of assisted respiration. Laboratory data included B-type natriuretic peptidase, serum creatinine, serum albumin, hemoglobin, aspartate aminotransferase, alanine aminotransferase, C-reactive protein, and eGFR levels at hospitalization. The Prognostic Nutritional Index (PNI) at hospitalization was adopted as the index of nutritional status. Echocardiography was performed by the standard protocol, and the left ventricular ejection fraction was measured by the modified Simpson method.

Definitions of short-term goal, early CR, and early acquisition of ambulation

The short-term goal was set to acquisition of 30 m of walking regardless of the use of a walking aid in the first week of CR with reference to the guidelines on rehabilitation in cardiac disease patients of the Japan Cardiovascular Society 2002 [20]. Early CR means acute treatment followed by a program of ambulation as soon as possible according to the guideline and that CR is implemented when early ambulation and acquisition of ADL are targeted. Early acquisition of walking was defined as the patient being able to walk a distance of 30 m within one week from the start of CR.

Rehabilitation program, start of rehabilitation, and criteria for progress in CR

In the absence of breathing difficulty at rest due to pulmonary congestion or fever, early rehabilitation progressed from head of the bed raised, to bedside sitting position, standing position, and walking [21]. At our hospital, physiotherapists carry out early rehabilitation based on the physician's instructions for rest and the criteria for the start and progression of rehabilitation. Physical therapists carried out early CR while monitoring the patient's vital signs and subjective symptoms. We complied with the guidelines of the Japan Cardiovascular Society [21]. In patients in whom it was difficult to judge when to start or advance rehabilitation, we consulted with the patient's physician.

Assessment of ADL

The FIM was developed to suit rehabilitative aspects of patients with disabilities, and it consists of two domains: motor and cognitive [22]. The motor domain (motor FIM) consists of 13 items: eating; grooming; bathing; dressing upper body; dressing lower body; toileting; bladder management; bowel management; transfer to bed, chair, or wheelchair; transfer to toilet; transfer to tub or shower; walking/wheelchair; and stairs. The cognitive domain (cognitive FIM) consists of 5 items: comprehension, expression, social interaction, problem solving, and memory. The FIM is scored from 1 to 7 points as follows: total assistance, 1 point; maximal assistance, 2 points; moderate assistance, 3 points; minimal contact assistance, 4 points; supervision, 5 points; modified independence, 6 points; and complete independence, 7 points. The minimum total FIM score is 18 points, and the maximum total FIM score is 126 points, with the minimum scores for motor FIM and cognitive FIM being 13 points and 5 points, and maximum scores being 91 points and 35 points, respectively. [23]

eGFR and PNI

The eGFR was calculated using the following formula: 194 × serum creatine$^{-1.094}$ × age$^{-0.28}$ (× 0.739 for females), as recommended by the Japanese Society of Nephrology [24]. The PNI includes the serum albumin level and total lymphocyte count [25] and is calculated as PNI = 10 × serum albumin concentration in g/dL + 0.005 × total lymphocyte count per mm^3.

Walking level before hospitalization

The cut-off criteria for pre-hospital walking levels were 1) independent outdoor walking, in which the subject could walk independently without any support; 2) assisted outdoor walking, in which the subject could walk outdoors using a cane or buggy, etc.; and 3) indoor walking, in which the subject could walk indoors with the aid of a cane or walking aid. Information on walking levels was initially obtained by the primary doctor or nurse, by a medical social worker who obtained it from the patient's family, or by the care manager who obtained it from the patient's electronic medical record. Alternatively, the physiotherapist in charge collected information directly from the patient, family, and care manager.

Statistical methods

To evaluate patient characteristics and clinical parameters in achieving the short-term goal, we performed the *t*-test, chi-square test, and Fisher exact test, as appropriate, on the data of the two groups. We also performed multivariate analyses to evaluate independent factors related to short-term goal achievement. In the multivariate analysis, the independent variable was the ability to achieve the short-term goal, and the dependent variables were the factors affecting

achievement of this goal. The following two items were input as the dependent variable. First were items with a significant difference observed in the univariate analysis, and second were items necessary for verifying our hypothesis. Because the diagnostic criteria for chronic kidney disease (CKD), such as eGFR <60 mL/min/1.73 m^2 for 3 months, were unclear from patient to patient, they were not input into the multivariate analysis. Baseline variables with a *p* value <0.05 in the univariate analysis were included in the multivariate analysis, and the odds ratio (OR) was computed with its 95% confidence interval (CI). Data are expressed as the mean ± standard deviation. A *p* value <0.05 was considered significant. Statistical analysis was performed using R ver. 2.8.1 statistical software (The R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Flow of included patients

A flowchart of the patients included in this study is shown in Figure 1. Among the 315 consecutive patients with HF who underwent rehabilitation, we excluded 135 patients because they met the exclusion criteria. Therefore, 180 patients were ultimately included and divided into the goal achievement group (*n* = 124) and non-goal achievement group (*n* = 56).

Patient characteristics

The patients' clinical characteristics between the goal achievement group and non-goal achievement group can be compared in Tables 1 and 2. Compared to the goal achievement group, the non-goal achievement group was significantly older and had higher rates of

complication from diabetes mellitus, CKD, and orthopedic disease and significantly lower hemoglobin, creatinine, eGFR, albumin, and PNI values at hospitalization, and motor FIM and cognitive FIM at discharge. In addition, walking level before hospitalization was significantly lower, and use of diuretics, length of hospital stay, and rates of discharge to home and of death were significantly higher ($p<0.05$).

Factors delaying progress in early CR

Table 3 shows the results of the multivariate analysis of factors related to short-term goal achievement. Logistic regression analysis was conducted with short-term goal achievement as the dependent variable and factors affecting this short-term achievement as the independent variables. Of the seven factors, walking level before hospitalization (OR = 3.144; 95% CI:1.757–5.626; $p = 0.0001$) and eGFR value at hospitalization (OR = 0.971; 95% CI: 0.950–0.9927; $p = 0.009$) were the factors significantly associated with delaying progress in early CR.

DISCUSSION

Factors delaying progress of elderly Japanese HF patients undergoing early CR

The aim of present study was to clarify the factors related to the acquisition of early ambulation in elderly Japanese patients with HF undergoing early CR. The results of the present study showed that even after adjusting for influencing factors such as age, anemia, comorbidities, and nutritional status, eGFR at hospitalization and walking level before hospitalization were extracted as the independent factors delaying progress in CR.

Previous studies have reported that the combination of anemia and renal hypofunction affects the decline in physical function more than each factor separately [26]. However, the present study found that renal dysfunctional alone was a factor in delaying patient progress in early rehabilitation. Previous studies have reported that malnutrition is a predictor of low body function in HF patients and that it can affect muscle mass and muscle strength of the upper and lower limb muscles [27]. Furthermore, common comorbidities in the elderly that further reduce exercise capacity and complicate therapy include diabetes, cerebrovascular and peripheral artery disease, orthopedic disease, and renal, pulmonary, and cognitive dysfunction [28]. However, in the present study, only walking level before hospitalization and renal dysfunction at hospitalization, rather than nutritional status and the existence of other complications, were factors delaying progress in early rehabilitation.

Physical impairments associated with chronic HF often worsen markedly with cardiac decompensation and can be further compounded by prolonged immobility associated with the hospital environment, thus creating profound impairments in physical function [29]. Therefore, patients with lower walking levels before hospitalization require more time to start early ambulation. In addition, because early acquisition of 30 m of walking is related to FIM at hospital discharge and length of stay, it is important to implement CR from early in the hospitalization. Furthermore, because exercise therapy at home for patients with HF improves physical function and walking ability [30], we are considering establishing a system that can provide continuous CR at home as a future task.

Acquisition of early ambulation and renal function

Impaired renal function commonly accompanies both acute and chronic HF [31]. Results from the ADHERE database of 118,465 hospitalization episodes show that the majority of patients admitted with acute decompensated HF have significant renal impairment that influences treatment and outcomes [32]. In the present study, the decline of eGFR at hospitalization was an independent factor delaying the early acquisition of ambulation.

In previous studies on CKD and decreased eGFR, physical function, exercise tolerability, and lower leg muscular strength of elderly patients with CKD before dialysis were lower than those of healthy subjects of the same generation [33,34]. Moreover, there is a positive correlation between GFR and exercise capacity in CKD patients [14]. In addition, in HF patients with CKD, exercise capacity decreased as eGFR decreased [35]. In the present study, patients with delayed acquisition of early ambulation may have decreased physical function and exercise tolerance due to renal dysfunction.

The reduction in renal function at hospital admission in the present study may be attributed to the pre-hospitalization presence of CKD [36], a decrease in the perfusion pressure of the arterial system, and an increase in renal congestion of the venous system due to the sudden reduction in cardiac function due to HF [37]. Therefore, eGFR at hospitalization may not reflect actual subacute or stable renal function due not only to the effect of existing CKD but also to the effect of HF, and the eGFR at admission may be lower than the actual eGFR. In addition, the effect of using a loop diuretic for relief of congestion due to HF treatment was considered as a cause of the decline in renal function during hospitalization [38]. To prevent both the progression of CKD before hospitalization and a decline in renal function during hospitalization, it is necessary

to improve dietary habits [39], treat HF, and adjust the loop diuretic agent in the course of treatment to relieve congestion. For these reasons, we believe it is important for the patient's physicians, nurses, physiotherapists, pharmacists, and dietician to consult with one another and to start treatment immediately after hospitalization.

Clinical implications

The present study was the first attempt, to our knowledge, to discover factors that can delay progress in early CR in elderly Japanese patients with HF. The results of this study indicate that it is possible to predict elderly HF patients who are likely to achieve short-term goals at an early stage of hospitalization based on their pre-hospital walking level and renal function at hospitalization. If elderly HF patients can walk 30 m in the early stage of CR during hospitalization, it may be possible to predict the length of hospital stay, and the possibility of walking independence at discharge may be high. In addition, knowledge of the pre-hospital walking level and renal function at hospitalization are important for setting short-term goals for early CR in elderly HF patients.

Study limitations

In this retrospective cohort study, the short-term goal was the ability to walk 30 m within 1 week of CR start, and progression of early CR was defined based on achievement of this goal although failure to meet this goal cannot be considered as the only factor delaying early CR progression. Second, evaluations of leg muscle strength, physical function, and exercise tolerance were not performed. Third, patients at indoor walking level may have comprised a mix of patients who were able to walk 30 m before hospitalization and those who were not. Therefore, because it is

unclear whether the patients could actually walk 30 m before hospitalization, the walking level before hospitalization was categorized as indoor walking level. Fourth, both acute HF patients and patients with acute exacerbation of chronic HF were included. Fifth, in the clinical setting of acute decompensated HF, serum creatinine levels and eGFR may only partially reflect renal dysfunction due to the effects of HF. Sixth, as possible selection bias, there were patients who were not prescribed CR even though they were hospitalized with acute HF. Seventh, the diagnosis of CKD may be inaccurate. Eighth, due to the specifics of the underlying condition (i.e., chronic HF), serum creatinine levels and eGFR may be influenced by additional factors such as malnutrition, muscle wasting, or other conditions. Thus, although we are convinced that our study population consists of a typical cohort of acute HF patients, we cannot exclude other effects on the data. Eighth, we did not investigate details related to diuretics that the patients may have received. Finally, there are some future tasks. 1. This study is a retrospective cohort study, and information obtained from prospective studies is needed. 2. Investigation of the number of patients with heart failure with preserved ejection fraction (HFpHF) and heart failure with reduced ejection fraction (HFrHF) in the HF phenotype is a task for future study. 3. To clarify the reason for achieving the short-term goal, it will be necessary to evaluate leg muscle strength and physical function and to clarify the presence or absence of sarcopenia.

Conclusion

The present study found the factors delaying progress in early CR in elderly Japanese patients with HF to be pre-hospital walking level and renal dysfunction on admission. Further research into progress in early rehabilitation and the physical and renal functions of elderly Japanese

patients with HF will be required in the future.

Conflict of interest:

All authors declare no conflicts of interest in relation to the work reported in this manuscript.

Abbreviations

ADL: activity of daily living

BMI: body mass index

CI: confidence interval

CKD: chronic kidney disease

CR: cardiac rehabilitation

eGFR: estimated glomerular filtration rate

FIM: Functional Independent Measure

HF: heart failure

LVEF: left ventricular ejection fraction

OR: odds ratio

PNI: Prognostic Nutritional Index

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Figure Legend

Fig. 1. Diagram of the process to select the elderly patients with heart failure.

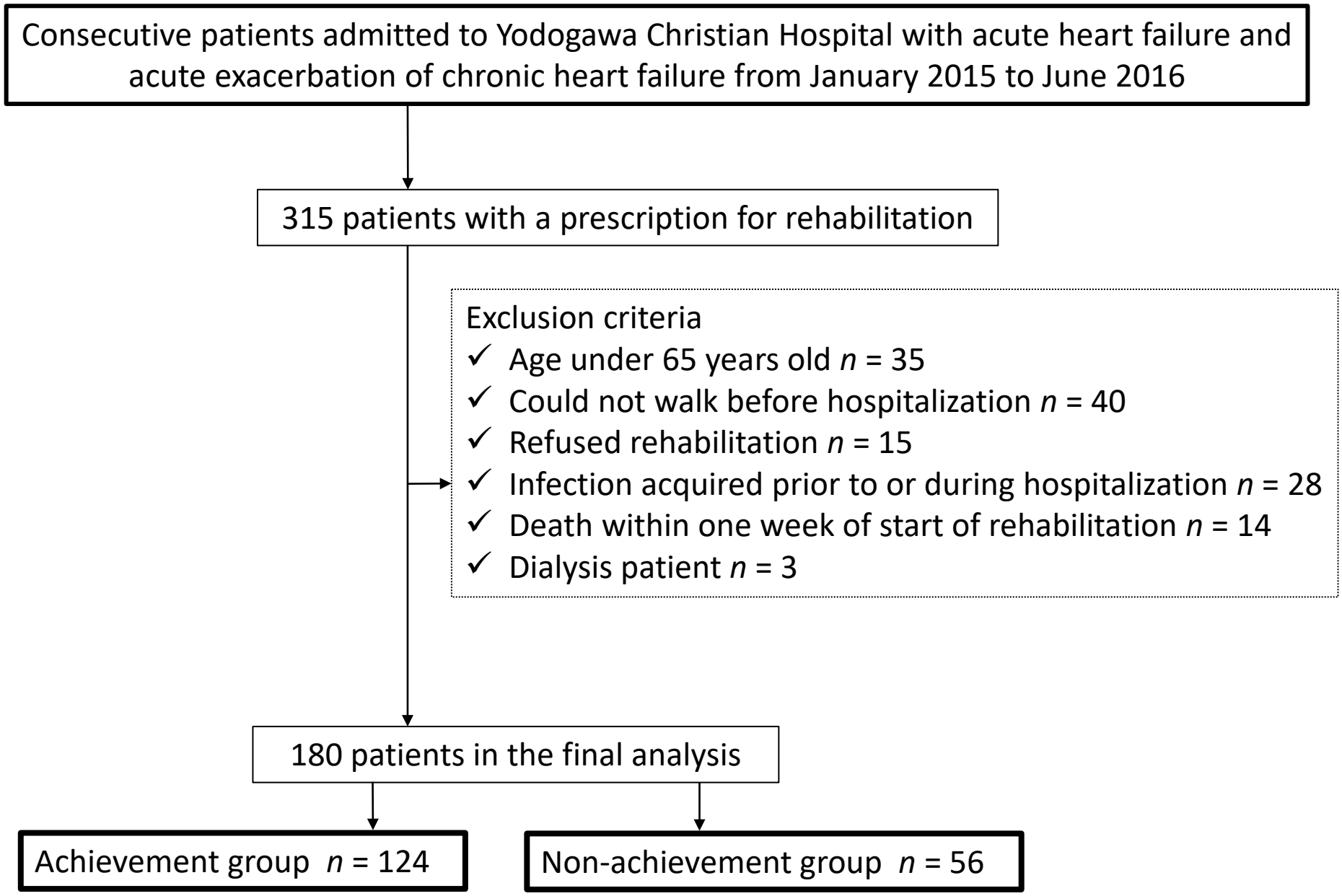
Consecutive patients admitted to Yodogawa Christian Hospital with acute heart failure and acute exacerbation of chronic heart failure from January 2015 to June 2016
315 patients with a prescription for rehabilitation
Exclusion criteria
✓ Age under 65 years old n = 35
✓ Could not walk before hospitalization n = 40
✓ Refused rehabilitation n = 15
✓ Infection acquired prior to or during hospitalization n = 28
✓ Death within one week of start of rehabilitation n = 14
✓ Dialysis patient n = 3
180 patients in the final analysis
Achievement group n = 124
Non-achievement group n = 56

Figure 1

Table 1

Patient characteristics.

Parameter	Total	Goal achievement group	Non-goal achievement group	t and X^2 value	*p* value
No. of patients	180	124	56		
Age (years)	84 ± 6.9	81.6 ± 8.02	84 ± 6.9	−2.029*	0.04
Male, n(%)	77 (40.5)	57 (45.9)	20 (35.7)	1.65	0.198
Body mass index (kg/m^2)	20.05 ± 4.0	19.8 ± 5.92	16.2 ± 8.6	0.9*	0.324
Comorbidity/Medical history, n (%)					
Hypertension	105 (58.3)	73 (58.8)	32 (57.1)	0.04	0.827
Dyslipidemia	59 (32.7)	41 (33.0)	18 (32.1)	0.01	0.902
Diabetes mellitus	82 (45.5)	48 (38.7)	34 (60.7)	7.53	0.006
Ischemic disease	76 (42.2)	55 (44.3)	21 (37.5)	0.74	0.388
Chronic kidney disease	65 (36.1)	37 (29.8)	28 (50.0)	6.79	0.009
Valvular disease	71 (57.2)	51 (41.1)	20 (57.1)	0.34	0.55
Atrial fibrillation	97 (53.8)	65 (52.4)	32 (57.1)	0.34	0.55
Pacemaker	31 (17.2)	23 (18.5)	8 (14.2)	-	0.53
After cardiac surgery	18 (10.0)	11 (8.87)	8 (14.2)	-	0.43
Orthopedic disease	52 (28.8)	30 (24.1)	22 (39.2)	4.27	0.038
Cerebrovascular disease	30 (16.6)	20 (16.1)	10 (17.8)	-	0.82
Respiratory disease	42 (23.3)	30 (16.6)	12 (21.4)	0.16	0.68
Number of heart failure admissions	2.6 ± 2.5	2.4 ± 2.5	2.9 ± 2.6	-1.21*	0.22
Left ventricular ejection fraction (%)	47.9 ± 15.2	47.9 ± 14.5	47.8 ± 16	-0.05*	0.97
Laboratory data					
Hemoglobin (g/dL)	11.3 ± 2.1	11.6 ± 1.9	10.7 ± 2.2	2.93*	0.004
Creatinine (mg/dL)	1.3 ± 0.8	1.2 ± 0.5	1.7 ± 1.1	-3.48*	<0.001
CRP (mg/dL)	1.0 ± 1.3	0.94 ± 1.2	1.4 ± 1.4	-1.973*	0.04
BNP (pg/dL)	902.7 ± 724.4	862.7 ± 670.4	1014.2 ± 827.4	-1.20*	0.23
eGFR (mL/min/1.73 m^2)	42.8 ± 20.8	47.2 ± 20.4	33.5 ± 18.7	-4.22*	<0.001
AST	38.4 ± 57.5	38.3 ± 45.0	38.5 ± 70.0	<-0.001*	0.99
ALT	31.7 ± 65.3	29.1 ± 34.6	34.4 ± 96.1	-0.04*	0.68

Albumin (g/dL)	3.57 ± 0.45	3.64 ± 0.43	3.42 ± 0.46	3.132*	0.002
PNI	35.8 ± 0.45	36.6 ± 4.4	34.0 ± 4.8	3.197*	0.002
Systolic blood pressure (mmHg)	135.8 ± 30.6	138.2 ± 32.3	131.1 ± 26.6	1.562*	0.12
Oxygen dose (L)	1.3 ± 0.4	2.3 ± 3.1	2.9 ± 2.9	-1.27*	0.2
Noninvasive positive pressure ventilation	7 (3.8)	4 (3.2)	3 (5.3)	-	0.67
Medications, n (%)					
Diuretics	170 (93.9)	106 (84.8)	54 (96.4)	4.67	0.03
β-blocker	114 (62.9)	77 (61.6)	37 (66.0)	0.26	0.68
ACE or ARB	58 (32.0)	40 (32.2)	18 (32.1)	-0.004	0.98
Calcium antagonist	59 (32.5)	39 (31.2)	20 (35.7)	0.31	0.57
Nitrate	22 (12.1)	14 (11.2)	8 (14.2)	-	0.62
Oral Cardiotonic	11 (6.1)	7 (5.6)	4 (7.1)	0.15	0.69
Intravenous cardiotonic	13 (7.2)	5 (4.0)	8 (14.7)	6.05	0.01

All measurements are presented as number (%). Values are mean ± standard deviation unless otherwise noted.

Abbreviations: CRP, C-reactive protein; BNP, B-type natriuretic peptid; eGFR, estimated glomerular filtration rate; AST, aspartate aminotransferase; ALT, alanine aminotransferase; PNI, prognostic nutritional index; ACE, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker. * value.

Table 2

Comparison of FIM and hospital stays between short-term target achievement group and non-achievement group.

	All patients (n = 180)	Goal achievement group (n = 124)	Non-goal achievement group (n = 56)	t and X^2 value	p value
CR initiation disease day (day)	3.9 ± 2.8	3.9 ± 2.8	4.0 ± 2.9	0.77*	0.438
Initial FIM total (points)	74.5 ± 25.7	81.4 ± 24.9	59.5 ± 20.9	6.05*	<0.001
Motion (points)	44.2 ± 22.4	50.1 ± 22.5	31.3 ± 16.9	6.18*	<0.001
Cognitive (points)	30.1 ± 7.4	31.0 ± 6.7	28.2 ± 8.5	2.11*	0.03
Total FIM at discharge (points)	100.4 ± 20.6	105.0 ± 18.1	87.0 ± 25.4	4.45*	<0.001
Motion (points)	68.6 ± 16.0	73.0 ± 14.0	58.0 ± 18.6	5.01*	<0.001
Cognitive (points)	31.3 ± 6.3	32.0 ± 5.9	29.0 ± 8.2	2.05*	0.04
Walking level before hospitalization (n, %) (Outdoor independence/Outdoor aidung/Indoor)	56/45/79 (31%/25%/44%)	53/35/36 (96%/77%/45%)	3/10/43 (4%/23%/55%)	39.03	<0.001
Number of HF admissions (times)	2.6 ± 2.5	2.4 ± 2.5	2.9 ± 2.6	-1.21*	0.22
Home reversion ratio (%)	150(83.3)	114(91.9%)	36(64.2%)	21.23	<0.001
Length of stay (days)	23.6 ± 15.1	19.5 ± 11.9	32.6 ± 17.3	-5.11*	<0.001

All measurements are presented as number (%). Values are mean ± standard deviation unless otherwise noted.

Abbreviations: CR, cardiac rehabilitation; FIM, Functional Independence Measure; HF, heart failure. *t value.

Table 3

Multivariate analysis of factors related to short-term goal achievement.

	OR	95% CI	Z value	P value
Age (years)	1.014	0.954-1.078	0.455	0.652
Walking level before hospitalization	3.395	1.786-6.456	3.731	0.0001
Diabetes mellitus, n (%)	0.755	0.318-1.790	-0.637	0.52
Chronic kidney disease, n (%)	0.964	0.368-2.526	-0.073	0.941
Orthopedic disease, n (%)	0.879	0.366-2.109	-0.287	0.774
Hemoglobin (g/dL)	1.092	0.873-1.367	0.775	0.438
eGFR (mL/min/1.73 m^2)	0.967	0.941-0.994	-2.357	0.018
CRP (mg/dL)	1.333	0.982-1.810	1.844	0.065
PNI	0.972	0.877-1.078	-0.542	0.587
Use of diuretic	0.471	0.049-4.486	-0.654	0.513

Abbreviations: CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; PNI, prognostic nutritional index; OR, odds ratio; CI, confidence interval.