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Original Article

Impact of Physical Frailty on Changes in Health-Related Quality of Life in Elderly Patients with Chronic Heart Disease after Discharge

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SUMMARY

Background: Health-related quality of life (HRQOL) is important in cardiac rehabilitation, particularly in elderly and their likelihood of re-hospitalization and mortality. The Japanese HRQOL concept comprises three categories and eight subscales. However, little research has been undertaken on the influence of frailty on the three HRQOL categories in elderly heart disease patients.
Methods: This study examines the influence of the presence or absence of frailty among elderly heart disease patients and their HRQOL at the time of their discharge from hospital and over the three months following their discharge. The subjects carried out between November 2016 and December 2017, were 40 elderly patients with chronic heart disease. We investigated subjects' characteristics, lifestyle habits, motor functions, frailty, and HRQOL at the time of discharge. We examined HRQOL and frailty at one and three months after discharge. We also investigated mortality and re-admission due to heart failure (HF re-admission) at six months after discharge by phone to the subjects.
Results: A comparison between frailty and non-frailty groups found no significant difference in almost measurements. About changes in HRQOL, only the social aspect of HRQOL was significantly lower in the frailty group compared to the non-frailty group, and significantly lower values at one and three months after discharge compared upon discharge in both groups.
Conclusion: This study suggests that the social aspect of HRQOL in elderly patients with chronic heart disease declines after one month of patient discharge. Moreover, patients exhibiting frailty at the time of discharge may show greater deterioration.

1. Introduction

With an aging rate of 27.7%, Japan has been categorized as a super-aging society. Indeed, of a total population of 126.71 million people, some 35.5 million were aged 65 or older on October 1, 2017.[1] An increase in elderly cardiovascular disease patients has also been reported in aging societies.[2] The increasing age of patients undergoing cardiac rehabilitation is resulting in growing attention to elderly patient care.

As a problem peculiar to the elderly, physical frailty (hereinafter, frailty) is a significant factor accompanying aging. Indeed, there is a high prevalence of frailty among the aged, often accompanied by a high risk of adverse health effects such as falls and dysfunction in daily life.[3] It has also been shown that frailty in elderly heart disease patients has a negative effect on both the mortality rate[4,5] and likelihood of re-hospitalization.[6] Moreover, research has demonstrated that frailty compounds heart failure and that heart disease is linked to the deterioration produced by frailty.[7] It has been reported that elderly patients with severe chronic obstructive pulmonary disease (COPD) are more prone to frailty and decreased acceptance of their disease in comparison to patients with other chronic diseases. Assessment and management of frailty in the care of older COPD patients is likely to improve risk stratification significantly and help personalize management, leading to better patient outcomes.[8] Because COPD and heart disease can be said to be similar diseases in the sense that they reduce physical function secondarily, the results of this COPD study indicate that evaluation of frailty can be considered especially important in elderly heart disease patients.

Health-related quality of life (HRQOL) — which is reflective of an individual's attitude toward health — is important in cardiac rehabilitation, particularly in elderly heart disease patients and their likelihood of re-hospitalization and mortality. Indeed, research has shown that frailty is associated with a decline in HRQOL,[9] including in elderly heart disease patients.[10,11] The Medical Outcome Study 36: Item Short Form Health Survey (SF-36) is often used to evaluate HRQOL. In the Japanese version, the structure of the HRQOL concept comprises three categories — namely, physical health, mental health, and social health — and eight subscales.[12]

However, little research has been undertaken on the influence of frailty on the three HRQOL categories in elderly heart disease patients.

Addressing this gap, this study investigates the influence of frailty on the three categories of HRQOL at the time of discharge

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from hospital. In doing so, this study suggests possible means of creating more appropriate comprehensive cardiac rehabilitation after discharge. As such, the purpose of this study is to examine the influence of frailty among elderly heart disease patients and their HRQOL at the time of their discharge from hospital and in the three months thereafter.

2. Patients and methods

2.1. Subjects

The subjects of this study were aged 65 years or older and hospitalized due to myocardial infarction or heart failure in the Kyushu Medical Center and Kyoto Katsura Hospital between November 2016 and December 2017. Subjects exhibited no signs of dementia and were able to perform all activities of daily living independently. Among elderly patients aged 65 years and older who were discharged to their homes, 40 patients (34 males, 6 females) who provided consent to participate in this study were selected. In addition, we set the sample size to 40 to analyze it using a division plot design (effect size: 0.25, α error: 0.05, power: 0.8) regarding the HRQOL result, which was measured three times for the two groups (frailty and non-frailty) in this study.

The study protocol was approved by Kyoto Tachibana University Ethics Review Committee (approval number: 16-16, 16-23). We explained the research to the subjects in advance by means of an informational form that explained the content, purpose, implication, and risks involved in the study. Having received sufficient written explanation, subjects provided their consent.

2.2. Study design

We conducted a longitudinal study. We collected subjects' characteristics, including age, gender, height, weight, body mass index (BMI), educational history, causal diseases, brain natriuretic peptide (BNP), and number of hospitalizations. We also collected data on their lifestyle habits: living alone, smoking history, falling experience, regular eating habits, regular bedtime, regular waking time, sleeping hours, presence of stress, participation in community activities, and employment. Data on frailty and HRQOL were obtained from the subjects' medical records and a questionnaire disseminated at the time of discharge. In addition, we performed Timed Up and Go (TUG) tests at both the maximum and normal speeds, testing grip strength, normal walking speed (5-metre walk), and motor functions. We investigated HRQOL and frailty at one and three months after discharge by mailing the questionnaire to the subjects. We also investigated mortality and re-admission due to heart failure (HF re-admission) at six months after discharge by phone to the subjects.

2.3. Evaluation of frailty

We employed the Kihon Checklist (KCL), a self-reporting tool used to identify frailty.[13] This study used 20 items of the 25-item KCL, excluding five items related to depression prevention/support.[14] The 20-point test comprised a total score of 20 points, with a score of more than six points or more indicating frailty and less than six points indicating non-frailty.

2.4. Assessment of HRQOL

We used SF-36 ver. 2 to assess the HRQOL of the study subjects.[9] We asked respondents to complete the SF-36 self-entry questionnaire and scored their responses using SF-36 ver. 2 Japanese version scoring program (2004, 2015). SF-36 consists of 36 items measuring eight health concepts: namely, physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. The Japanese version is organized around their superordinate categories — namely, physical health, mental health, and social health — with eight subscales. Based on these categories, we utilized a three-component scoring method[9] developed in 2011 to calculate scores. This method comprises a physical component summary (PCS), mental component summary score (MCS), and role/social component summary (RCS). Each SF-36 score used norm-based scoring (NBS) based on the national standard value. This scoring method is a re-calculation of the 0–100 score, so that the national standard value of the average Japanese citizen is 50 points while its standard deviation is 10 points. In SF-36 ver. 2, the NBS score is regarded as an international standard score.[15]

2.5. Statistical analysis

G*Power 3.0.0 was used to calculate the required sample size. Firstly, we performed Fisher's exact test, Chi-square test and t-test to compare non-frailty group and frailty group indexes (such as mean, standard deviation, proportion). In addition, we showed the changes in HRQOL three months after discharge with repeated measure of analysis of variance using the mean value and the standard deviation. Bonferroni correction was used for the post-hoc test. Finally, analysis of variance for split-plot factorial design was used to compare changes in each side of the SF-36 in two groups — namely, frailty and non-frailty — and over the investigation period. Bonferroni correction was used for the post-hoc test. The significance level was set at 5%, and IBM SPSS ver. 24.0 was used for all analyses.

3. Results

The average age of the 40 respondents was 75.1 $\pm$ 6.6 years. In terms of gender, 34 (85%) respondents were male and six (15%) were female. Eighteen (45.0%) respondents were evaluated as being frail at the time of their discharge. In comparison to subjects who were determined as not being frail (non-frailty group), their TUG time at normal speed was significantly shorter than subjects evaluated as frail (frailty group) (p = 0.004). However, no significant difference was found between the two groups in other subjects' characteristics (p = 0.06–1.00), lifestyle habits (p = 0.11–0.93), and motor functions (p = 0.80–0.85). Moreover, there was no significant difference (p = 0.08–0.10) between the two groups in terms of HRQOL at the time of discharge. There were no significant differences between the two groups in terms of mortality (p = 0.31) at 6 months of discharge and HF re-admission (p = 0.20), too (Table 1). Regarding changes in HRQOL, only role emotion of non-frailty group was significantly lower 3 months after discharge than at discharge (p = 0.024), but there was no significant difference elsewhere (Table 2).

Of the subjects judged as frail at the time of discharge (n = 18), approximately 40% were determined to be non-frail after three months (n = 7), while 61.1% were still frail (n = 11). Meanwhile, of subjects judged as non-frail at the time of discharge (n = 22), about 27.3% of subjects were found to be frail three months after their discharge from hospital (n = 6) (Figure 1).

Analysis of variance for split-plot factorial design was used to compare changes in each side of the SF-36 in the two groups (frailty and non-frailty) and the investigation period. PCS showed no significant effect in regard to the presence or absence of frailty (p =

Table 1
Comparison between the non-frailty and frailty groups.

	Non-frailty (N = 22, 55.0%)	Frailty (N = 18, 45.0%)	p value
Subjects' characteristics			
Age (y.o.)	74.0 ± 5.7	76.3 ± 7.3	0.29
Female (%)	13.6%	16.7%	> 0.99
Height (m)	1.6 ± 0.1	1.6 ± 0.1	0.90
Weight (kg)	61.3 ± 5.9	60.1 ± 10.6	0.68
BMI (kg/m^2)	23.1 ± 2.0	22.4 ± 2.8	0.39
Education (years)	12.8 ± 2.3	11.6 ± 1.1	0.06
Disease (HF (%) : MI (%))	36.4% : 63.6%	44.4% : 55.6%	0.75
BNP (pg/ml)	420.4 ± 315.3	447.4 ± 451.8	0.85
Number of hospitalizations (times)	1.9 ± 1.0	1.8 ± 1.0	0.94
Lifestyle habits			
Living alone (%)	95.5%	77.8%	0.16
Current smoker (%)	9.1%	16.7%	0.64
Fall experience (%)	9.1%	16.7%	0.65
Eat regularly everyday (%)	90.9%	100.0%	0.49
Regularly go to bed (%)	86.4%	94.4%	0.61
Regularly wake up (%)	90.9%	100.0%	0.49
Sleeping time (hours/day)	7.9 ± 1.8	7.9 ± 1.7	0.93
Day-to-day strong stress (%)	27.3%	50.0%	0.19
Participation in community activities (%)	72.7%	44.4%	0.11
Employment (%)	45.5%	27.8%	0.33
Motor functions			
TUG at the normal speed (sec)	8.1 ± 2.3	10.4 ± 2.3	0.004
TUG at the maximum speed (sec)	7.8 ± 5.0	8.0 ± 2.1	0.83
Grip (kg)	32.4 ± 10.2	33.1 ± 11.3	0.85
Walking speed (sec)	5.3 ± 2.0	5.4 ± 1.4	0.80
HRQOL (SF-36 summary scores)			
PCS at discharge	41.7 ± 10.4	35.2 ± 13.1	0.10
MCS at discharge	56.4 ± 11.7	54.6 ± 6.2	0.08
RCS at discharge	47.8 ± 13.4	39.8 ± 15.5	0.10
Prognosis			
Mortality (6 months)	4.5%	16.7%	0.31
HF re-admission (6 months)	0.0%	11.1%	0.20

Values are mean ± standard deviation or proportion (%).

Table 2
Changes in HRQOL (SF-36 subscale scores) three months after discharge.

	At discharge	One month after discharge	Three months after discharge
PF			
Non-frailty	43.4 ± 12.9	44.7 ± 13	42.7 ± 13.1
Frailty	34 ± 17.8	35.4 ± 15.3	33 ± 15
RP			
Non-frailty	42.9 ± 13.6	43.8 ± 13	40.9 ± 15
Frailty	35.4 ± 14.9	29.1 ± 11.8	30.2 ± 11.9
BP			
Non-frailty	49.5 ± 12	52.6 ± 10	50.4 ± 8.8
Frailty	37.9 ± 9.9	44.9 ± 6.7	46.4 ± 9.5
GH			
Non-frailty	48 ± 8.9	46.9 ± 10.9	47.1 ± 9.9
Frailty	43.1 ± 9.3	44.4 ± 9.8	44.7 ± 7.5
VT			
Non-frailty	54.1 ± 11.6	54.8 ± 9.1	52.9 ± 9.4
Frailty	47 ± 8.2	47.2 ± 8.7	48 ± 10.2
SF			
Non-frailty	49.1 ± 12.7	47.6 ± 11.8	47.9 ± 11.9
Frailty	40.2 ± 10.5	38.8 ± 10.1	39.5 ± 9.3
RE			
Non-frailty	49.1 ± 10.6	45.1 ± 14.6	41.7 ± 14*
Frailty	38.5 ± 15.2	30.6 ± 12.2	33.4 ± 11.7
MH			
Non-frailty	54.3 ± 8.7	53.2 ± 9.1	51.7 ± 9.2
Frailty	45.7 ± 9	46.8 ± 8.6	46.2 ± 8.7

Values are mean ± standard deviation or proportion (%), *: At discharge vs. three months after discharge.
PF: physical functioning; RP: role physical; BP: bodily pain; GH: general health; VT: vitality; SF: social functioning; RE: role emotional; MH: mental health.

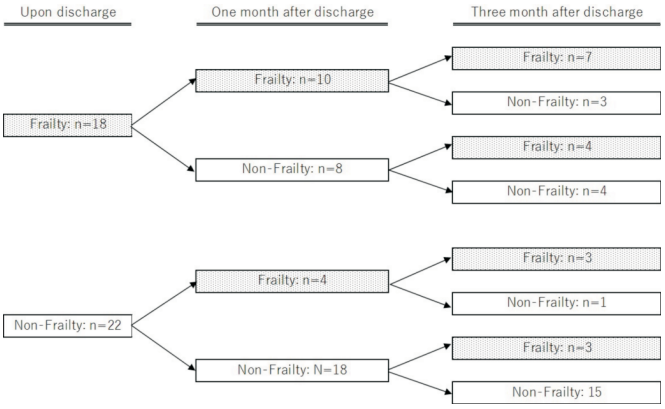

Figure 1. Changes in frailty status after discharge.

0.08, $p = 0.11$), and no interaction ($p = 0.91$) was observed (Figure 2). As in the case of PCS, MCS showed no significant effects ($p = 0.38$, $p = 0.17$) with or without frailty, and no interaction ($p = 0.15$) was observed (Figure 3). In the results of the RCS, however, the main effect was observed in both the presence and absence of frailty ($p = 0.003$) and the investigation period ($p = 0.008$); no interaction was observed ($p = 0.33$). Examination of the investigation period showed that there was significantly more deterioration at one month ($p = 0.03$) and three months ($p = 0.04$) after discharge than at the point of discharge (Figure 4).

4. Discussion

This study examined the influence of the presence or absence

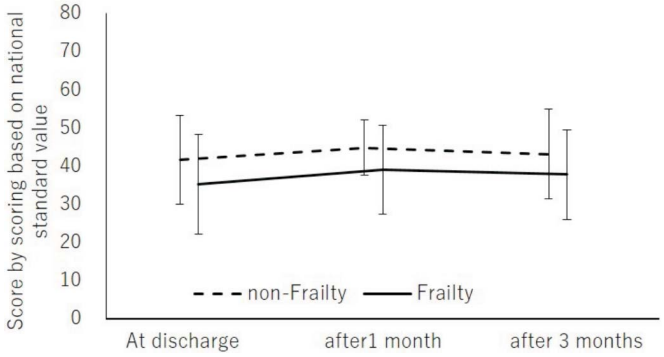

Figure 2. Changes in physical component summary after discharge with and without frailty.

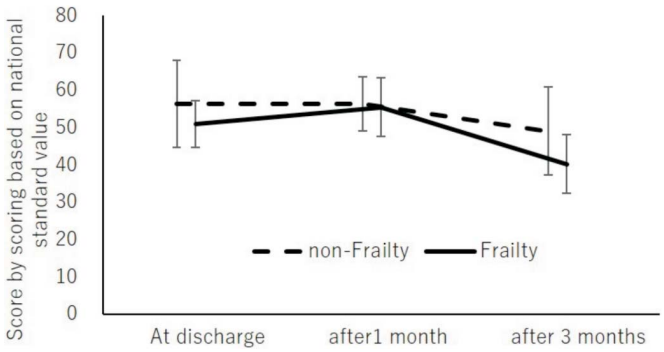

Figure 3. Changes in mental component summary after discharge with and without frailty.

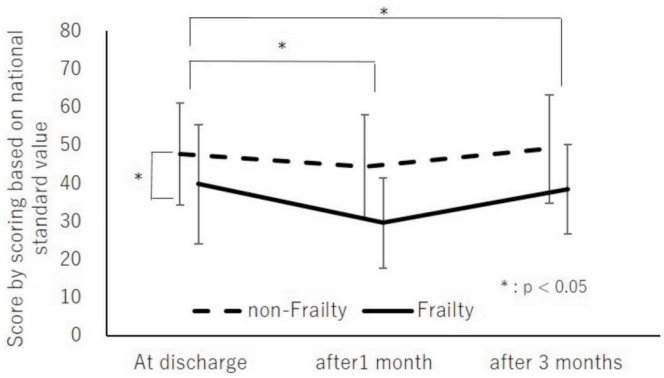

Figure 4. Changes in role/social component summary after discharge with and without frailty.

of frailty at the time of discharge on changes in the HRQOL of elderly patients with chronic heart disease following their discharge from hospital. In order to do so, we evaluated frailty/non-frailty at the time of discharge and examined their HRQOL in the three months after their discharge. With the exception of TUG at normal speed, a comparison between frailty and non-frailty groups showed no significant difference in measurements. In terms of HRQOL at three months after discharge, there was no significant difference between PCS and MCS between the two groups and no significant difference was observed with elapsed time. However, RCS was significantly lower in the frailty groups, while both groups showed significantly lower values at one and three months after discharge.

A cross-sectional study of 100 heart failure patients in Europe reported that 89% of patients evidenced frailty, and they had significantly lower PCS and MCS compared to patients without frailty.[12] Although this result differs from that of this study, this difference is likely due to the fact that the primary disease differs in the two studies. In contrast to limiting the study to heart failure only, this study includes subjects with both heart failure and myocardial infarction. This may result in a difference in the rate of frailty (85% vs. 45%). Another difference between these two studies is that the former used the two-component SF-36 model because the research was conducted in Europe and the United States, whereas this study used the three-component model for the Japanese context. As such, comparison between the results of these studies is difficult.

With the exception of TUG at normal speed, this study found no significant difference between the two groups in terms of subjects' characteristics, lifestyle habits, motor functions, and prognosis. This may be attributable to the fact that we recruited subjects with relatively high physical capabilities; that is, subjects who were able to move independently and were discharged to their homes. Regarding HRQOL, subscale scores show almost no significant change on standing, only RCS showed a significantly low value, with both groups showing low values at the one- and three-month mark in comparison to the time of discharge. This indicates that social health is easily inhibited, which may be a characteristic of Japanese society; however, it is difficult to pursue the cause from the results of this study.

This study reports that RCS at the point of hospital discharge worsened after one month, and that subjects found to be frail showed significant deterioration compared to those who were not frail. Since cardiac rehabilitation improves HRQOL,[16] it is thought that performing outpatient cardiac rehabilitation is necessary in all cases of elderly patients with chronic heart disease. However, the spread of outpatient cardiac rehabilitation has not been overly popular with limited implementation of facilities, particularly in Japan.[17] Since the spread of home-based cardiac rehabilitation[18] reportedly has equivalent effects on outpatient cardiac rehabilitation for HRQOL, such measures are also necessary. Considering the remarkable deterioration in the RCS of our subjects presenting frailty at the time of discharge, we suggest that greater support be provided at the time of discharge, especially for frail patients. For example, we think that it may be necessary to make arrangements for them to exercise in their living areas under the supervision of cardiac rehabilitation experts, and to encourage communication among them. This will also provide them with greater opportunities for social participation. Since Japan is the world's most aged country, the results of this study may offer useful suggestions to countries with aging societies for the care of elderly patients with chronic heart disease after they are discharged.

This study has some limitations. Notable, there is a possibility of selection bias. Moreover, because the number of cases was small, myocardial infarction and heart failure were mixed as causal diseases. Furthermore, SF-36 calculated at the national standard value was used to evaluate subjects' HRQOL. However, since this survey covers the circumstances of subjects during a relatively stable period in the one month after discharge, it is possible that HRQOL may not be fully reflected in SF-36. These problems may limit our research results. We think that these problems may be resolved by conducting large-scale multicenter research using methods that can evaluate acute HRQOL.

5. Conclusion

This study indicates that the role/social aspect of HRQOL in elderly patients with chronic heart disease declines in the month following their discharge from hospital, and that patients exhibiting frailty at the point of discharge may exhibit greater deterioration. Therefore, it may be necessary to have an active strategy for elderly patients with chronic heart disease who exhibit frailty at the time of

discharge. Moreover, such strategies should place particular focus on providing opportunities for social participation.

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Declarations of interest

None.

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