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ORIGINAL RESEARCH

Preserved physical fitness is associated with lower 1-year mortality in frail elderly patients with a severe comorbidity burden

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Introduction: Physical deterioration in connection with a care episode is common. The aim of this study was, in frail elderly patients with a severe comorbidity burden, to analyze 1) the association between physical fitness measurements and 1-year mortality and 2) the association between preserved physical fitness during the first three months after discharge from emergency hospital care and 1-year prognosis.

Methods: Frail elderly patients ($\geq$75 years) in need of inpatient emergency medical care were included. Aerobic capacity (six-minute walk test, 6MWT) and muscle strength (handgrip strength test, HS) were assessed during the hospital stay and at a three-month follow-up. The results were analyzed using multivariate Cox regression; 1) 0–12-month analysis and 2) 0–3-month change in physical fitness in relation to 1-year mortality. The analyses were adjusted for age, gender, comorbidity and frailty.

Results: This study comprised 408 frail elderly hospitalized patients of whom 390 were evaluable (mean age 85.7 years, Charlson's index mean 6.8). The three-month mortality was 11.5% and the 1-year mortality was 37.9%. After adjustments, the Cox-regression analysis showed that both 6MWT and HS were associated with 1-year mortality, HR_{6MWT} 3.31 (95% CI 1.89–5.78, $p<0.001$) and HR_{HS} 2.39 (95% CI 1.33–4.27, $p=0.003$). The 0–3-month change in the 6MWT and the HS were associated with 1-year mortality, where patients who deteriorated had a poorer prognosis than those with improved fitness, HR_{6MWT} 3.80 (95% CI 1.42–10.06, $p=0.007$) and HR_{HS} 2.21 (95% CI 1.07–4.58, $p=0.032$).

Conclusion: In frail elderly patients with a severe comorbidity burden, physical fitness in connection with emergency hospital care was independently associated with 1-year mortality. Moreover, a change in physical fitness during the first months after hospital care was important for the long-term prognosis. These results emphasize the importance of providing hospital care designed to prevent physical deterioration in frail elderly patients.

Keywords: frail elderly, mortality, physical fitness, six-minute walk test, handgrip strength test, in-hospital rehabilitation

Introduction

Society faces a major challenge in designing healthcare to provide good care for an increasing number of frail elderly patients. When people age, multimorbidity, disability and cognitive impairment become more common, which places substantial demands on healthcare systems.[1,2]

Frailty is a dynamic syndrome with known negative health outcomes, which can improve and worsen over time.[3] A frail person is often characterized by a reduced physiological reserve and increased vulnerability, which poses a high risk of a recurrent need

for hospitalization, institutionalization and death.[4] In this condition, critical illness requiring hospitalization and prolonged bed rest are associated with physical deterioration and functional impairment persisting for a long time after hospital discharge.[5–8] It has been reported that among old, independently walking patients, almost 20% require assistance after discharge from a period of medical inpatient care.[9] Suboptimal post-hospital recovery leads to a negative spiral in physical function, which in turn affects the ability to maintain independence and is strongly associated with a reduced ability to benefit from medical interventions and an even poorer prognosis.[10–13]

There is no consensus definition of frailty, but most researchers agree that there are two types of frailty; physical and psychological, where the occurrence of sarcopenia and diminished muscle strength is one important discriminatory characteristic.[14,15] One commonly used definition is *The accumulation of deficits model*, which adds together a person's different diseases and disabilities to produce an index.[16] Fried's definition[17] of physical frailty includes the following components: unintended weight loss, muscle weakness, self-reported exhaustion, slow gait speed and reduced physical activity. It identifies a frail person if three or more of these are fulfilled.

In frail elderly patients, hospital care is often acute and necessarily has a medical focus.[1,18] The association between physical deterioration and hospital care is well known, but, despite this, interventions to counteract progressive disability are unusual.[5,19] It has been shown that frail patients benefit from an interdisciplinary and holistic perspective of care, where well-structured rehabilitation is routinely part of the hospital treatment.[20–22] Comprehensive Geriatric Assessment (CGA) is one care model with documented beneficial effects in terms of mortality, disability and cognitive functions.[23] Recently, CGA was found to be superior to conventional medical care in preserving aerobic capacity, muscle strength and mobility three months after discharge from hospital in frail, acutely ill elderly patients.[24] The multi-professional approach, comprising early assessment, interdisciplinary care, including regular team meetings, educational efforts and good access to assistive devices, is regarded as crucial for the prevention of functional decline. This means that there is still rehabilitation potential, even in frail elderly patients.

The aim of this study was, in frail elderly patients with a severe comorbidity burden, to analyze 1) the association between physical fitness measurements and 1-year mortality and 2) the association between a preserved physical fitness during the first three months after discharge from emergency hospital care and 1-year prognosis.

Materials and methods

This study is a sub-study from the project entitled "Is the Treatment of Frail Elderly Patients Effective in an Elderly Care Unit" (TREEE), which is a prospective controlled clinical trial carried out at the NU (NÄL-Uddevalla) Hospital Group, in western Sweden. This sub-study focuses on how physical fitness-related variables are associated with mortality and uses a different main outcome (1-year mortality in comparison to previously reported 3-month mortality). All the participants in the study gave their written informed consent, by themselves or by proxy. The study was conducted in accordance with the Declaration of Helsinki and approved by the regional ethical review board in Gothenburg (Entry no: 8883-12, December 12, 2012) and registered at the Swedish National Database of Research and Development; identifier 113021 (http://www.researchweb.org/is/vgr/project/113021), November 4, 2012.

Data collection and procedure

The original study design, inclusion-and exclusion criteria, methods and characteristics of the cohort have already been reported.[25]

Between March 2013 and July 2015, patients aged 75 years or more, frail according to the FRail Elderly Support researcH group (FRESH) screening instrument[26,27] and in need of inpatient emergency medical care were included in the study. Patients with severe acute illness suitable for specialized hospital units, eg, acute myocardial infarction or stroke, were excluded from the study, as were patients whose informed consent could not be obtained.

Patients were identified by a general practitioner at the health care center or by the ambulance staff. When they found a person aged 75 years or more and in need of medical inpatient care, they called the geriatric emergency department (ED) and the patient was screened for frailty. If the patient was considered frail, he or she became eligible for the study. The patient could be allocated to a general medical ward, or to a ward using a CGA working model. After the patient was admitted to the ward, oral and written information was given and consent was obtained from the patient, or, if necessary, from the patient's next of kin. Clinical and demographic characteristics were collected from medical records. All the participants performed tests of physical fitness during the index hospital stay. In connection with a follow-up visit to the hospital or in the patient's home three months later, the same variables were registered. After one year, information on date of death was obtained through the medical records or the National Registry of Records.

Both tests of physical fitness were performed by experienced physical therapists, except in a few cases where they were performed by a specifically trained physician. In order to maintain good inter-rater reliability, the test procedure was repeated and calibrated several times before the study began and again during the study period, with the aim of ensuring that all the assessors would perform the test procedure in the most similar manner possible.

Because of the participants' often severe condition and sometimes due to organizational difficulties, it was not possible to standardize the day of the first test. The aim was to perform tests when the participant was medically stabilized, in most cases toward the end of the hospital stay. Missing could be due to discharge before the tests were performed, the patient chose to renounce the test, the patient did not understand the instructions, (eg, due to severe dementia), or in a few cases due to the hand-dynamometer was missing. Some follow-up visits were made in the patients' homes. When there was no access to a 30-meter straight stretch, the six-minute walk test (6MWT) was reported as missing.

Measurements
Physical fitness
The 6MWT was originally designed to measure sub-maximal aerobic capacity in patients with cardiorespiratory diseases[28] and it has shown good test–retest reliability in community-dwelling elderly (ICC=0.95).[29] When performing the test, the person walks back and forth along a 30-meter corridor with markings every five meters. The instruction is to walk as far as possible during a six-minute period. In the present study, patients were allowed to stop and continue during the test, but the test was interrupted if the patient was unable to complete, usually due to dyspnea and dizziness. Walking aids were allowed.

The handgrip strength (HS) test is a valid test of muscle strength and has been shown to have good test–retest reliability in community-dwelling elderly and in older persons with dementia (ICC=0.97).[30,31] The HS test was performed using an hydraulic hand dynamometer (SAEHAN) with the option of an individually adapted grip position.[30] The patient had to be in a sitting position with his/her arm next to the body, the elbow flexed at 90° and the wrist in a neutral position and he/she was then instructed to squeeze the dominant hand as hard as possible and relax. The result is the peak value (kg) of three attempts, with a short rest (about one minute) between each attempt. A few patients did not manage to sit independently. They were allowed to lie in bed with the head end raised and the elbow supported.

Patient descriptive characteristics
Age, gender and other demographics were identified and retrieved from medical records or in conversation with the patient or the patient's next of kin.

Frailty was assessed by a nurse or physician at the time of inclusion, using the FRESH screening instrument.[26,27] The original FRESH consists of five items related to tiredness, falls, endurance, needing support while shopping and three or more visits to the ED in the past 12 months. If the patient fulfills two or more of the items, he or she is considered to be frail. The four physical questions (ED visits excluded) has been validated to identify frail individuals in an emergency hospital setting compared with the frailty phenotype indicators.[26] The four-question FRESH screening instrument has been shown to have good sensitivity (81%) and specificity (80%).[26] In this study the fifth question about ED-visits was omitted.

Comorbidity is a frequently used predictor of mortality. Charlson's Comorbidity Index (CCI)[32] is a validated instrument for assessing the comorbidity burden and predicting short- and long-term mortality in an acute medical setting.[33] The CCI consists of 19 conditions, each of which is given a severity weighting depending on the risk of dying associated with this condition. From this an index is produced, which may give an indication of the prognosis. In a previous study, a CCI of ≥3 was regarded as a substantial comorbidity burden.[34] In this study, the assessing physician completed the CCI before discharge and again at the three-month follow-up visit.

Statistical analyses
This study is a sub-study of the research project known as TREEE. The sample size calculation was based on the primary outcome, ie a decline in ADL (Katz index) from baseline to three months after discharge. The power analysis has been previously described.[24]

The data were computerized and analyzed using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 22.0, Armonk, NY: IBM Corp).

The characteristics of the population at baseline and at the three-month follow-up were described as continuous variables and divided into categories. Time to death was analyzed using the number of days after discharge from hospital.

The hazard ratios (HR) were calculated using the results of the physical fitness measurements (6MWT and HS) in two different models of multivariate Cox proportional hazard regression analysis. First, a model analyzing the baseline values of physical fitness in relation to all-cause 1-year mortality,

and the second model analyzing the 0–3 months change in physical fitness in relation to all-cause 1-year mortality. The proportional hazard assumption was visually evaluated with log minus log plots and Schoenfeld residuals and in addition analyzed by modeling of the interaction between time and each covariate. The proportional hazard assumption was met in all presented models. The analyses were adjusted for age, gender, comorbidity burden and degree of frailty. In addition, the second analysis was adjusted for the index measurement value.

In the first analysis, HS was dichotomized as low versus normal based on a previously used definition of sarcopenia (normal >20 kg women, >30 kg men).[35] The results for the 6MWT were divided into the categories of 0–100 m, 101–200 m and >200 m, which were adapted to fit our population where most patients walked only short distances. Patients who did not manage to perform the tests were categorized as low HS or in the 0–100 m group. In the second analysis, the 0–3 month changes were trichotomized as decline, stability and improvement. There were no consensus definitions of the minimal clinically important change for frail elderly hospitalized patients in relation to the measurements used. The cut-off values for each test had to be stipulated from a statistical viewpoint. As a result, the change from index to follow-up of the study population was used and if it had decreased by one quartile or more, it was assumed to be a relevant decline. HS: decline less than −2 kg, stable −1 kg to +2 kg, improvement +3 kg or more. 6MWT: decline less than −50 m, stable −49 m to +23 m, improvement more than +24 m.

Results

In this study 408 hospitalized frail elderly patients (56.7% females, mean age 85.7 years, age range 75–99 years) were included. Eighteen patients died during the index hospital stay. The post-hospitalization mortality was calculated for those 390 patients discharged alive. The patients were heavily affected by diseases, especially cardiovascular disease. The most common diagnoses were renal failure (87%), hypertension (71%), heart failure (40%), ischemic heart disease (30%) and cerebrovascular disease (26%). During the first three months after discharge 11.5% of the patients died and after one year mortality was 37.9%, see the flow chart in Figure 1. For index and three-month characteristics of the population, see Table 1.

The Cox-regression analysis showed that both the 6MWT at index and the change during the first three months

were associated with 1-year mortality. The adjusted hazard ratios were HR_{6MWT} 3.31 (95% CI 1.89–5.78, $p < 0.001$) for 1-year mortality, where those with a walking distance of <100 m at index ran a higher risk of dying than those who walked >200 m. Patients who declined during the first three months ran a higher risk of poorer 1-year prognosis than those who improved in walking distance, $HR_{6MWT\ decline}$ 3.80 (95% CI 1.44–10.06, $p = 0.007$), see Table 2 and Figure 2. In addition, the adjusted analysis showed that a high comorbidity burden at index (CCI ≥8) and male gender were associated with higher mortality, but degree of frailty and age did not have a significant influence, see Table 3.

The Cox regression analysis showed that both low HS at index and a decline in HS during the first three months were associated with 1-year mortality. The adjusted hazard ratios were $HR_{HS\ low}$ 2.39 (95% CI 1.33–4.27, $p = 0.003$) for 1-year mortality and patients who declined during the first three months had higher risk of poorer 1-year prognosis than those who improved in HS, $HR_{HS\ decline}$ 2.21 (95% CI 1.07–4.58, $p = 0.032$), see Table 2 and Figure 2. In addition, the adjusted analysis showed that a high comorbidity burden at index (CCI ≥8) and male gender were associated with higher mortality, but degree of frailty and age did not have a significant influence, see Table 3.

Discussion

To our knowledge, this is the first study that has shown that both walking distance and HS at baseline are associated with 1-year mortality. The results also demonstrate that the preservation of or improvement in physical fitness during the first three months after hospital care is associated with better long-term survival. If the patient declined in terms of walking distance or HS and did not recover in the first three months after hospitalization, the 1-year mortality rate was higher compared with those who preserved or improved their physical fitness.

It is well known that poor cardiorespiratory fitness and muscle strength are associated with increased mortality in healthy individuals[36,37] but, as yet, this has not been extensively investigated in frail patients with a severe comorbidity burden. In the present study, poor physical fitness was independently associated with higher 1-year mortality, which is consistent with previous research on hospitalized elderly patients,[38] showing that HS and the ability to perform the 6MWT at the time of hospital discharge were predictive of the long-term prognosis. Previous research on elderly patients with chronic obstructive pulmonary disease found a walking
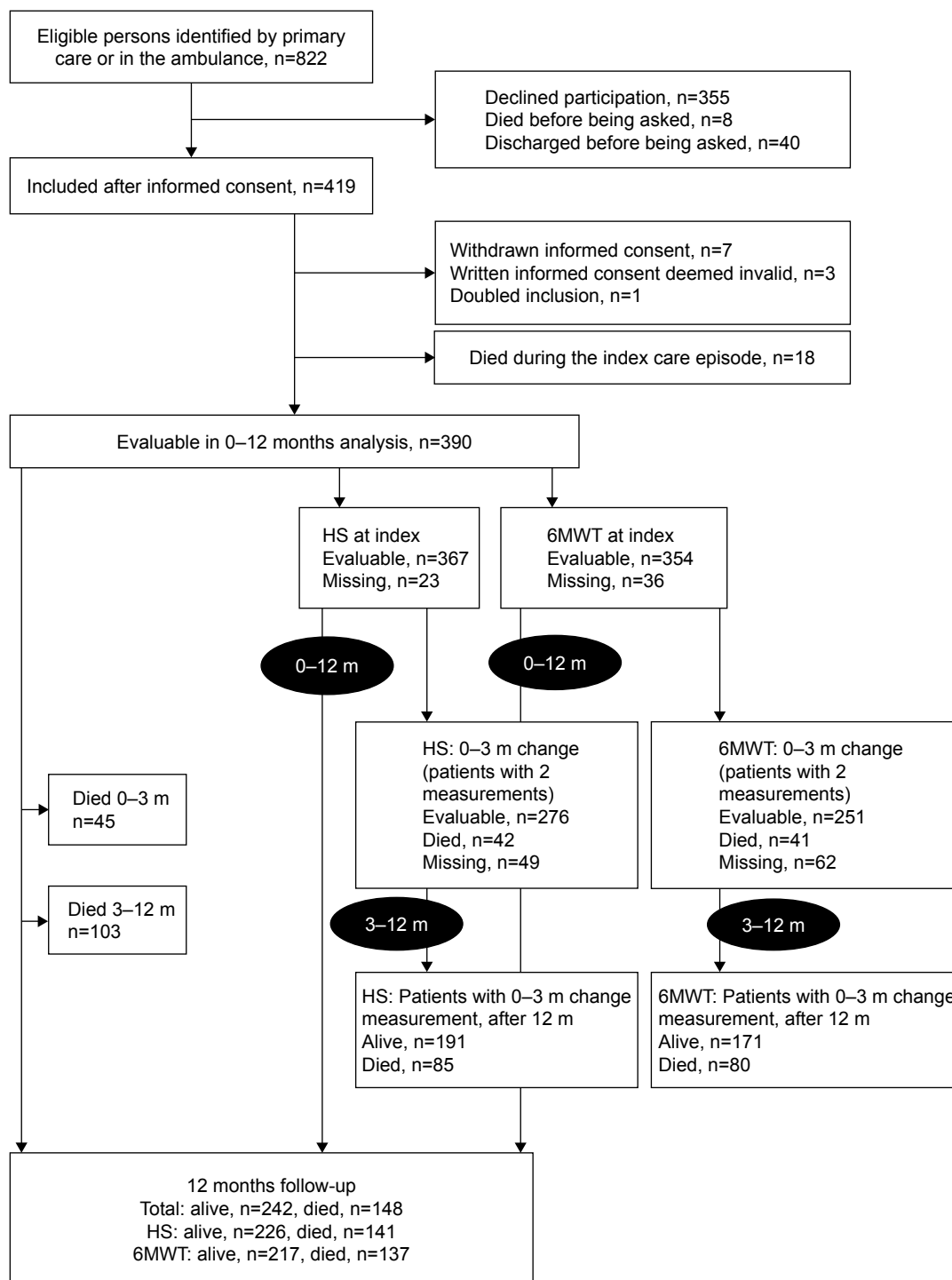
Figure 1 Flowchart of data collection. Flowchart for patients evaluated for physical fitness; both "performers" and "not-able to perform" are included. 0–12 m: show the flowchart for analysis index value of measurement in relation to 1-year mortality. 3–12 m: show the flowchart for analysis change in physical fitness 0–3 in relation to 1-year mortality.
Abbreviations: 6MWT, six-minute walk test; HS, handgrip strength.

distance in the 6MWT of below 330 m was associated with an increased risk of dying[39] and if the cutoff was lowered to <200 m, the analysis showed even better sensitivity and specificity in relation to mortality.[40] In frail patients with heart failure, a walking distance of <300 m was associated with increased mortality.[41] The present study indicates that, in hospitalized frail elderly patients with a severe comorbidity burden even shorter distances may have a prognostic

Table 1 Characteristics of the population

Variables	N	Index	N	3 months
Deaths n (%)	–	–	390	45 (11.5)
Age, years, mean (SD)	390	85.7 (5.4)	345	85.6 (5.4)
Gender, female n (%)	390	221 (56.7)	345	203 (58.8)
CCI, mean (SD)	390	6.8 (1.9)	345	6.8 (1.8)
CCI 4–5, n (%)	390	104 (26.7)	345	86 (24.9)
CCI 6–7, n (%)	390	173 (44.4)	345	152 (44.1)
CCI ≥8, n (%)	390	113 (29.0)	345	107 (31.0)
Frailty, median, (min–max)	390	3.0 (2–5)	339	3.0 (0–5)
Frailty 1–2, n (%)	390	85 (21.8)	339	111 (32.7)
Frailty 3, n (%)	390	166 (42.6)	339	107 (31.6)
Frailty 4, n (%)	390	139 (35.6)	339	121 (35.7)
Lived alone, n (%)	390	258 (66.2)	345	225 (65.2)
Nursing home, n (%)	390	48 (12.3)	345	78 (22.6)
6MWT, m, mean (SD)	354	112 (102)	272	101 (101)
6MWT >200 m, n (%)		76 (21.5)		51 (18.8)
6MWT 101–200 m, n (%)		81 (22.9)		52 (19.1)
6MWT 0–100 m, n (%)		197 (55.6)		169 (62.1)
HS, kg, mean (SD)	367	17.7 (7.3)	289	18.3 (7.6)
HS normal, n (%)		66 (18.0)		64 (22.1)
HS, low, n (%)		301 (82.0)		225 (77.9)
6MWT, patients with measurements at both index and at 3 months, n (%)			345	251 (72.8)
HS, patients with measurements at both index and at 3 months, n (%)			345	276 (80.0)

Notes: CCI: Charlson's comorbidity index. Frailty was assessed with the FRESH-screening instrument (0–5). The degree of frailty was assessed and then divided in groups from the four-question FRESH-screening instrument (5th question excluded) (range 1–4). Normal HS: >20 kg (women) and >30 kg (men). 6MWT, mean (SD): patients who did not manage to perform the test are included with value 25 m and in the 0–100 m group. HS, mean (SD): patients who did not manage to perform the test are included with value 10 kg and in the low HS group.
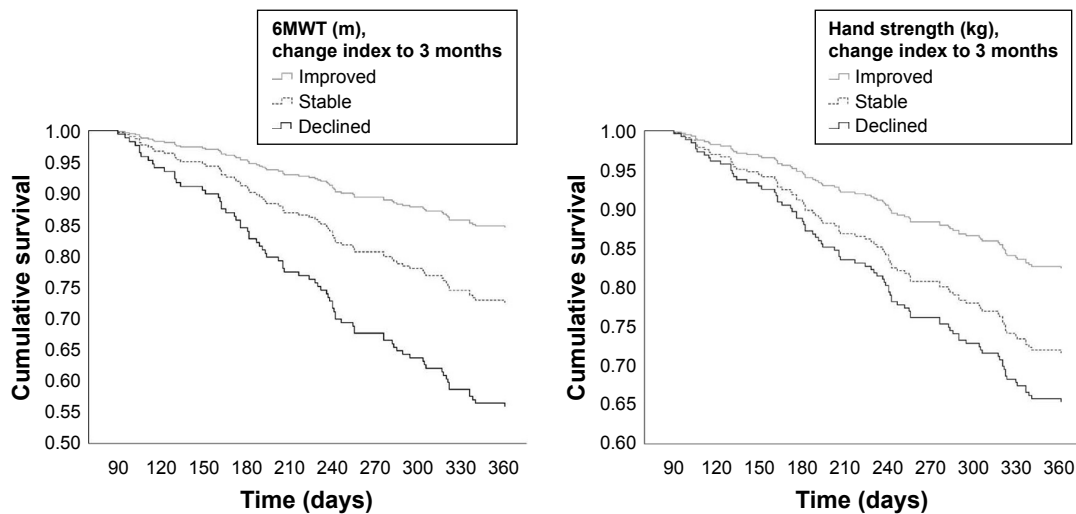**Abbreviations:** 6MWT, six-minute walk test; HS, handgrip strength.

Table 2 1-year mortality in relation to performance in HS and 6 MWT

1-year mortality in relation to physical fitness at index						1-year mortality in relation to change in physical fitness during the first 3 months after discharge					
Index	N/n deaths	Unadjusted		Adjusted		0–3 months change	N/n deaths	Unadjusted		Adjusted	
		HR (95% CI)	P-value	HR (95% CI)	P-value			HR (95% CI)	P-value	HR (95% CI)	P-value
6MWT	354/137					**6MWT**	251/80				
>200 m	76/15	1		1		Improved	40/7	1		1	
101–200 m	81/23	1.47 (0.77–2.82)	0.243	1.60 (0.83–3.09)	0.165	Stable	161/57	2.36 (1.08–5.18)	0.032	2.04 (0.91–4.56)	0.085
0–100 m	197/99	3.29 (1.91–5.66)	<0.001	3.31 (1.89–5.78)	<0.001	Decline	50/16	2.10 (0.86–5.11)	0.101	3.80 (1.42–10.06)	0.007
HS	367/141					**HS**	276/85				
Normal	66/13	1		1		Improved	61/15	1		1	
						Stable	153/50	1.39 (0.78–2.48)	0.261	1.73 (0.94–3.19)	0.077
Low	301/128	2.57 (1.45–4.54)	0.001	2.39 (1.33–4.27)	0.003	Decline	62/20	1.34 (0.69–2.61)	0.394	2.21 (1.07–4.58)	0.032

Notes: 1-year mortality is adjusted for gender, age, CCI and frailty screening. 1-year mortality related to the 0–3 months change is adjusted for gender, age, CCI, frailty screening and the index value of measurement (HS or 6MWT). 6MWT: a decline is defined as –50 m or more, stable as –49 to +23 m and improvement as +24 m or more. HS: a decline is defined as –2 kg or more, stable as –1 to +2 kg and improvement as +3 kg or more. Normal HS is defined as >20 kg (women) and >30 kg (men). HS below these values is defined as low. In the analysis, patients who did not manage to perform the tests were categorized as low HS or 10 kg and 0–100 m or 25 m.
Abbreviations: 6MWT, six-minute walk test; HS, handgrip strength; HR, hazard ratio; CCI, Charlson's comorbidity index.

Figure 2 Survival function. The 0–3 months change in physical fitness in relation to 1-year mortality. Plots of cumulative survival showing the association between change in physical fitness during the first 3 months after discharge from hospital and the 1-year mortality. The results are adjusted by gender, age, CCI, frailty screening and the index value of measurement (HS or 6MWT).
Abbreviations: 6MWT, six-minute walk test; HS, handgrip strength.

impact. Even after taking account of other factors relevant to mortality, in patients who walked <100 m in the 6MWT, the risk of dying was more than three times higher than in those who walked >200 m.

In a study of ambulatory old patients with heart failure (age 85.2 years and CCI 3.2) recently discharged from hospital, the prevalence of frailty, based on Fried's criteria, was associated with 1-year mortality.[42] Frail patients ran a greater

Table 3 The importance of different covariates in the Cox-regression analysis

Covariates	1-year mortality in relation to physical fitness at index		1-year mortality in relation to change in physical fitness the first 3 months after discharge	
	HR (95% CI)	**P-value**	**HR (95% CI)**	**P-value**
6MWT-analysis				
Age	1.02 (0.99–1.05)	0.304	1.03 (0.99–1.08)	0.167
Frailty 1–2	1		1	
Frailty 3	0.77 (0.47–1.25)	0.290	0.62 (0.32–1.19)	0.149
Frailty 4	1.13 (0.70–1.81)	0.628	0.83 (0.44–1.57)	0.570
CCI 4–5	1		1	
CCI 6–7	1.07 (0.67–1.68)	0.787	1.26 (0.68–2.32)	0.457
CCI ≥8	1.69 (1.05–2.70)	0.030	2.18 (1.15–4.16)	0.017
Gender (male)	1.69 (1.19–2.38)	0.003	1.57 (0.94–2.48)	0.053
Index value of 6MWT			1.00 (0.99–1.00)	0.002
HS-analysis				
Age	1.02 (0.98–1.05)	0.366	1.02 (0.98–1.06)	0.34
Frailty 1–2	1		1	
Frailty 3	0.92 (0.57–1.47)	0.721	0.72 (0.39–1.34)	0.298
Frailty 4	1.48 (0.93–2.34)	0.097	0.95 (0.51–1.78)	0.878
CCI 4–5	1		1	
CCI 6–7	0.98 (0.62–1.53)	0.917	1.14 (0.64–2.04)	0.649
CCI ≥8	1.70 (1.07–2.68)	0.024	2.01 (1.08–3.73)	0.028
Gender (male)	1.76 (1.25–2.48)	0.001	2.40 (1.47–3.90)	<0.001
Index value of HS			0.93 (0.90–0.97)	0.001

Notes: The degree of frailty was assessed and then divided in groups from the four-question FRESH-screening instrument (5th question excluded) (range 1–4). In the analysis, patients who did not managed to perform the tests were categorized as 25 m and 10 kg.
Abbreviations: 6MWT, six-minute walk test; HS, handgrip strength; CCI, Charlson's comorbidity index; HR, hazard ratio.

risk of physical decline compared with non-frail patients, but, as single markers, the authors found no significant associations between slow gait speed or muscle weakness and mortality. These results are contrary to those in the present study. It is probably that the already reduced margins in a frail patient play a major role and make a frail, severely ill patient more likely to deteriorate further, which in turn appears to be associated with an increased risk of dying.

Most studies focus on improvements after an intervention. In the present study, it is important to note that, in a group of frail elderly patients with a severe comorbidity burden, even interventions that prevent deterioration appear to be valuable in a longer perspective. There are examples of care that routinely work for the preservation of physical fitness in hospitalized patients. Recently, another study from the TREEE study was published. It found that hospital care in a CGA unit was superior in terms of preserving physical fitness in frail elderly patients over a three-month follow-up period, compared with conventional care.[24] Some intensive care units work in a structured manner on the early mobilization of critically ill patients, including early initiated activities that help restore cardiopulmonary and muscular systems, prevent joint contractures and focus on the patient's autonomy at an early stage. Improvements in the recovery of physical function and quality of life in both frail and non-frail elderly patients have been reported.[21,43] It is probable that the interdisciplinary approach in these care units contributes to that result.

Physical function is an important factor when decisions about nursing homes are to be taken and it is crucial for the ability to ambulate, maintain independence in daily activities and maintain good autonomy, factors that are rated as important by older people.[44] Small improvements in physical function can have a major impact on the quality of life of severely ill patients.[45]

Mobility limitations and morbidity are strong predictors of higher inpatient and post-acute healthcare utilization.[46] A study of the cost-effectiveness of CGA units for acutely ill frail elderly patients indicated that CGA might be cost-effective in comparison to conventional care.[47] Based on estimated population demographics in the coming years, with increasing numbers of aging people in society, CGA should be a reasonable alternative for more patients in daily hospital care.

Limitations

The results of this study need to be considered in relation to the study limitations. The patients were first assessed during their index hospital stay and then again in connection with a follow-up visit three months later. The first analysis used the index value of measurements for the 6MWT and HS in relation to 1-year mortality. In this analysis, all patients who survived the index hospital stay were included. The second analysis used the differences between the index- and the three-month assessments in relation to 1 year-mortality. This analysis only included patients who survived the first three months and were assessed for physical fitness twice. To improve the generalizability and enable the inclusion of as many patients as possible, those assessed as "not able to perform" were categorized in the lowest group, ie, <100 m and <10 kg. The main strength of the study is probably the clinical setting, where this study succeeded in measuring a 1-year mortality based on objective values of physical fitness in a population of hospitalized frail elderly patients with a severe comorbidity burden. From the perspective of rehabilitation, it appears to be important that these patients are able to benefit from interventions that simply preserve physical fitness. In relation to prognostic long-term effects, avoiding deterioration and not only improvement should be the aim.

Conclusion

Physical fitness in connection with emergency hospital care is independently associated with 1-year mortality. Moreover, the preservation of or improvement in physical fitness during the first months after hospital care is associated with a better long-term prognosis. These results emphasize the importance of evaluating physical fitness and offering interventions to prevent physical decline in frail elderly patients.

Acknowledgment

Disclosure

The authors report no conflicts of interest in this work.

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