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Association between Geriatric Hospitalized Patients' Frailty Status and Outcomes

YOSEF PURWOKO[1,2], KRIS PRANARKA[1,2], REJEKI ANDAYANI[1,2]
[1]*Geriatric Division, Department of Internal Medicine, Faculty of Medicine, Diponegoro University, Semarang, Indonesia*
[2]*dr. Kariadi Hospital Semarang, Semarang, Indonesia*
Correspondence to Yosef Purwoko, Email: yosefpurwoko@gmail.com, Telp: +622476928010

ABSTRACT

Background: Frailty results in a high risk of other health outcomes, including fall, decreased mobility and independence, hospital care, and death.
Aim: To demonstrate the correlation between geriatric hospitalized patients' frailty status and outcomes
Methods: This was a cross sectional study to evaluate the frailty and followed by a prospective cohort to measure geriatric hospitalized patients' outcomes. Subjects were 72 geriatric patients (≥ 60 years). Patients with communication difficulty, severe cognitive impairment, severe deficit in consciousness and physical performance were excluded. Frailty status was measured using Frailty Index-40 items (FI- 40). Other instruments used were Geriatric Depression Scale 15 and 30, Mini-Mental State Examination, Barthel Index and Mini Nutritional Assessment Questionnaire.
Results: Frail event, prevail, and fit/robust category were 45.3%, 26.7% and 28.0% respectively. Length of stay in frail subjects was 16.7±10.06, fit/robust subjects was 15.5±13.64, and prefrail subjects was 10.6±5.64 days (p=0.06). As many as 79.4% subjects with frail and 90.0% prefrail subjects were discharged from the hospital alive, while the fit/robust category were all alive/improved and only 20.6% subjects with frail were discharged due to death (p=0.1). Correlation test showed a significant negative correlation with moderate degree between FI categories and the length of stay (r=-0.43; p<0.001).
Conclusion: There is a correlation between geriatric hospitalized patients' frailty status and outcomes in Dr. Kariadi Hospital Semarang.
Keywords: Frailty, geriatric hospitalized patient, discharge status, length of stay

INTRODUCTION

Life expectancy in the society is one of social welfare indicators of a nation. The increase in the life expectancy will result in a geriatric society throughout the years. Statistical report showed that the projection of Indonesians will increase from 219.8 million in 2005 into 270.5 millions in 2025. The proportion of the elderly above 60 years old increased from 4.9% to 8.1%. As a consequence, the more amount of the geriatric population, the more health problems related to the elderly[1].

Frailty is estimated to have an increased prevalence along with the increase of age[2]. Frailty is a biological syndrome marked by the declines in endurance and strength towards stressors resulting in cumulative deterioration in physiological system. When the process is simultaneous, it will cause frailty and induces health problems. The clinical concept of frailty can also be described as decline in bodily function and physical performance related to the changes in the elderly. The term frailty is frequently used in a condition where the elderly have health problems, the loss of physiological performance, and other similar declines[3]. Frailty results in a high risk of other health outcomes, including fall, decreased mobility and independence, hospital care, and death.[4]

Some studies showed that frailty is not only about physical condition, but further it affects the phenotypes including psychological and psychosocial characteristics. Studies in the population using some frailty criteria, are reported to have average of 7% to 32% frailty with increased prevalence in advanced age[4].

Outcomes in the geriatric hospitalized patients are affected by many factors including frailty status and other influencing factors. Possible influencing factors are coming from patients such as sex and age, depression status and cognitive function, nutritional status, co morbidities; and non-medical factors such as economy and history of employment.[5] Information of factors influencing the geriatric hospitalized patients' outcomes is important to decrease the patients' morbidity and mortality. However the field of the study is limited especially in Indonesia.

The study is aimed at demonstrating the association between frailty status and hospitalized geriatric patients' outcome in Dr. Kariadi Hospital Semarang.

MATERIAL AND METHODS

The design of the study was a cross sectional study to evaluate the frailty status and its contributing factors and followed by a prospective cohort to evaluate the association between frailty status & geriatric pts' outcomes.
Subjects: The subjects were geriatric patients whom were hospitalized in the Geriatric and Rajawali ward in Dr. Kariadi Hospital Semarang from September to November 2017. The inclusion criteria were ≥ 60 years old and the patients or the family gave permission to be included in the study. Patients with communication difficulty, mental disorders, and severe cognitive impairment and/ or with consciousness and physical disorder were excluded from the study. Subjects were selected using a consecutive sampling. Sample size was determined using a single sample size formula and drop out was estimated to be 20% resulting in a minimum of 43 samples.
Study variables: The independent variable was frailty status/ frailty index (FI) determined using Frailty Index-40

items (FI- 40). FI categories are fit/robust if the score is ≤ 0.08, prefrail if the score is from 0.08 to 0.25 and frail if the score is ≥ 0.25.

The dependent variables were geriatric hospitalized patients' outcomes in Dr. Kariadi Hospital Semarang. Geriatric patients' outcomes were discharge status and hospital length of stay. Discharge status was the condition of the subject when being discharged from the hospital, can be alive/ improved or deceased. Hospital length of stay was measured since the subjects were hospitalized to the discharge described in numbers of days.

Confounding variables were sex, age, depression status, cognitive function and independence status in daily life, nutritional status, the number of disease history, education, economy status and history of employment.

Depression statuses of the subjects were measured with geriatric depression scale 15. The categories of depression geriatric scale 15 were suggestive depression (score ≥ 5) and no depression (score < 5). If suggestive depression was found, then the measurement was continued with geriatric depression scale 30. The category of the latter was no depression (score 0-9), mild depression (score 10-19) and severe depression (score 20-30). Cognitive function status was determined using Mini Mental Status Examination (MMSE). The categories for MMSE are no cognitive impairment (≥24-30), mild cognitive impairment (18-23) and severe cognitive impairment (≤18). Independence status in daily life was measured using Barthel index. The categories for Barthel index were independent (20), mild dependence (12-19), moderate dependence (9-11), severe dependence (5-8) and total dependence (0-4). Body Mass Index was assessed using Asia Pacific Body Mass Index (BMI). The formula is body weight (kg)/ height $(m)^2$. BMI is categorized into underweight (<18), normoweight (18.0-23) and overweight (> 23). Nutritional status was measured using Mini Nutritional Assessment (MNA). The categories are normal (12-14), risk for malnutrition (8-11), and malnutrition (0-7).

Data Collection and Analysis: Interviews to obtain patients' history or anamnesis were done using questionnaire/ standard scores that were tested for their validity and reliability. Association test between frailty and discharge status and length of stay of geriatric patients outcomes were analyzed with χ^2test. Regression multivariate test was done because two confounding variables were found significantly associated with frailty in the bivariate analysis. The association between frailty and length of stay was analyzed using rank-Spearman correlation test. P value was significant if p< 0,05. Data analysis was done using IBM SPSS version 21.

Ethical clearance: The study asked for a permission from the Ethical Committee of Health in the Faculty of Medicine Diponegoro University/Dr. Kariadi Hospital Semarang with Ethical Clearance no. 574/EC/FK-RSDK/IX/2017 and Research Permit in Dr Kariadi Hospital no. DL.00.02/I.II/4502/2017.

RESULTS

Characteristic of subjects: The study included 71 geriatric patients who were hospitalized in Geriatric and Rajawali ward of Dr. Kariadi Hospital Semarang during the study period (Table1).

Table 1 showed that most of the subjects were women (66.2%). The average age in the subjects was 70.6±7.86 with the youngest of 60 years old and the oldest of 91 years old. The average age of male subjects was 73.4±8.09 years old which was significantly older compared to the female subjects which were 69.3±7.44 years old. Educational status in the subjects was low/elementary school (53.5%). Most subjects (52.1%) were unemployed or housewife women. The average length of stay in subjects was 13.6±8.19 days with the shortest period of stay for 5 days and the longest for 46 days. Discharge status was mostly (87.3%) alive/improved and 12.7% dead.

Frailty index: Categories of frailty index (FI) of the subjects are shown in Figure 1. Figure 1 showed that most subjects were in the frail category (47.9%), followed by the prefrail (28.2%) and fit/robust (23.9%). Table 2 showed factors that significantly affected on frailty index were depression status, cognitive impairment and dependence status in daily lives. Most subjects with frail (50.0%), pre frail (75.0%) and all fit/robust subjects (100%) were not depressed. Depression was found more in subjects with frail (26.5%) and pre frail (20.0%). Statistical test showed significant difference in depression status based on FI categories (p=0.005). Most subjects with frail (47.1%) suffered from severe cognitive impairment, while in prefrail group, it was found that 15.0% subjects suffered from severe depression. In the most fit/robust (94.1%) there was no cognitive impairment, and only 1 subject (5.9%) suffered from mild depression. Statistical test showed a significant difference in distribution of cognitive function based on FI categories (p=0.001). Table 2 also showed that the frail subjects (38.2%) had severe dependence. In the pre frail (45%) and fit/robust (58.8%) most subjects suffered from mild dependence. The independent subjects were mostly in the fit/robust category (23.5%). Statistical test showed significant difference in daily life independence status based on FI category (p<0.001).

Logistic regression analysis was then employed for cognitive impairment, depressions sstatus, and daily life independence on frailty factors. The result of multivariate logistic regression test was shown in table 3. Table 3 showed that daily living independence status was a significantly impactful factor on frailty. Subjects with total dependence had risks for 2.7-fold frailty (CI 95%=1.2 up to 6.3) greater than the subjects who were independence. The factor about cognitive impairment and depression status cannot be concluded as an impactful factor on frailty because of the 95% CI over the value of 1.

FI categories and discharge status: The association between FI categories and discharge status showed on table 4. Table 4 showed that subjects with *frail* (79.4%) and *pre frail* (90.0%) were mostly being discharged alive, while subjects with *fit/robust* all were discharged alive/ with improvement. The table also showed most subjects who died were frail. Statistical analysis showed that the difference was not significant (p=0.1).

FI categories and length of stay: Length of stay based on FI categories are shown in table 5. Table 5 showed that the longest period of stay in subjects with frail was the frail group which was 17.2±9.66 days, and the shortest period was the fit/robust group for 9.3±3.75 days. Statistical analysis showed that the difference in length of stay based on FI categories were significant (p=0.01). The association

between FI categories with length of stay is shown in figure 2. Correlation test showed a significantly negative correlation with moderate degree between FI categories and length of stay (r=-0.43; p<0.001). This showed that the more severe the FI categories the longer the hospital stay.

Table 1: Characteristic of study subjects (n=71)

Characteristics	Mean±SD; median (min-max)	n (%)
Gender	-	
Men	-	24 (33.8)
Women	-	47 (66.2)
Age (years)	70.6±7.86; 70 (60 - 91)	-
Age of men	73.4±8.09; 74 (60 - 87)	-
Age of women	69.3±7.44; 67 (60 - 91)	-
Education		
No formal school	-	20 (28.2)
Low (elementary)	-	38 (53.5)
Middle (high school)	-	13 (18.3)
Occupation		
Stay at home	-	37 (52.1)
Retired	-	5 (7.0)
Working	-	29 (40.8)
Length of stay (days)	13.6±8.19; 11 (5 - 46)	-
Discharge status		
Alive/improved	-	62 (87.3)
Death	-	9 (12.7)

Note: SD= standard deviation; min= minimum; max= maximum

Table 2: Factors that may influence the frailty index (n=71)

Factors	Categories of Frailty Index			P*
	Frail	Prefrail	Fit/robust	
Men	12 (35.3%)	6 (30.0%)	6 (35.3%)	0.9
Women	22 (64.7%)	14 (70.0%)	11 (64.7%)	
Age category				
60 - 69 years old	15 (44.1%)	11 (55.0%)	8 (47.1%)	0.7
≥70 years old	19 (55.9%)	9 (45.0%)	9 (52.9%)	
Depression status				
Not depressed	17 (50.0%)	15 (75.0%)	17 (100%)	0.005
Depressed	9 (26.5%)	4 (20.0%)	0 (0.0%)	
Undefined	8 (23.5%)	1 (5.0%)	0 (0.0%)	
Cognitive function impairment				
Severe	16 (47.1%)	3 (15.0%)	0 (0.0%)	0.001
Mild	6 (17.6%)	2 (10.0%)	1 (5.9%)	
No impairment	12 (35.3%)	15 (75.0%)	16 (94.1%)	
Independence status				
Total dependence	10 (29.4%)	1 (5.0%)	0 (0.0%)	<0.001
Severe dependence	13 (38.2%)	1 (5.0%)	1 (5.9%)	
Moderate dependence	10 (29.4%)	6 (30.0%)	2 (11.8%)	
Mild dependence	1 (2.9%)	9 (45.0%)	10 (58.8%)	
Independent	0 (0.0%)	3 (15.0%)	5 (23.5%)	
Nutritional status				
Underweight	15 (44.1%)	7 (35.0%)	4 (23.5%)	0.7
Normoweight	11 (32.4%)	7 (35.0%)	8 (47.1%)	
Overweight	8 (23.5%)	6 (30.0%)	5 (29.4%)	
Malnutrition	16 (47.1%)	4 (20.0%)	8 (47.1%)	0.2
Risk for malnutrition	6 (17.6%)	9 (45.0%)	4 (23.5%)	
Normal	12 (35.3%)	7 (35.0%)	5 (29.4%)	
Education				
No formal school	10 (29.4%)	7 (35.0%)	3 (17.6%)	0.3
Low	16 (47.1%)	9 (45.0%)	13 (76.5%)	
Middle	8 (23.5%)	4 (20.0%)	1 (5.9%)	
Income				
< IDR 2,125,000	30 (88.2%)	15 (75.0%)	14(82.4%)	0.4
≥IDR 2,125,000	4 (11.8%)	5 (25.0%)	3 (17.6%)	
Occupation				
Unemployed/ stay at home	20 (58.8%)	11 (55.0%)	6 (35.3%)	0.1
Retired	2 (5.9%)	3 (15.0%)	0 (0.0%)	
Working	12 (35.3%)	6 (30.0%)	11 (64.7%)	

Percentage based on rows. *χ^2test.

Table 3. Factors influencing the frailty events (n=71)

Factors	OR	(95% IK)	P
Cognitive function impairment	3.4	(0.4 s/d 25.7)	0.2
Depression status	3.9	(0.4 s/d 37.2)	0.2
ndependence status in daily life	**2.7**	(1.2 s/d 6.3)	**0.02**

OR= odd ratio; K= confidence interval Percentage based on columns

Table 4 The association between FI categories and discharge status (n=71)

FI Categories	Discharge status		Total
	Death	Alive/improved	
Frail	7 (20.6%)	27 (79.4%)	34 (100%)
Prefrail	2 (10.0%)	18 (90.0%)	20 (100%)
Fit/robust	0 (0.0%)	17 (100%)	17 (100%)
Total	9 (12.7%)	64 (87.3%)	71 (100%)

p=0.1; χ^2test Percentage based on rows

Table 5. Length of stay (days) based on FI categories

FI Categories	Mean±SD; Median (Min – Max)	p§
Frail	17.2±9.66; 15 (5 - 46)	0.01
Pre frail	11.1±5.17; 10 (6 - 27)	
Fit/robust	9.3±3.75; 8 (5 - 18)	

§ Kruskall Wallis test

Figure 1. Categories of frailty index distribution in the subjects (n=71)

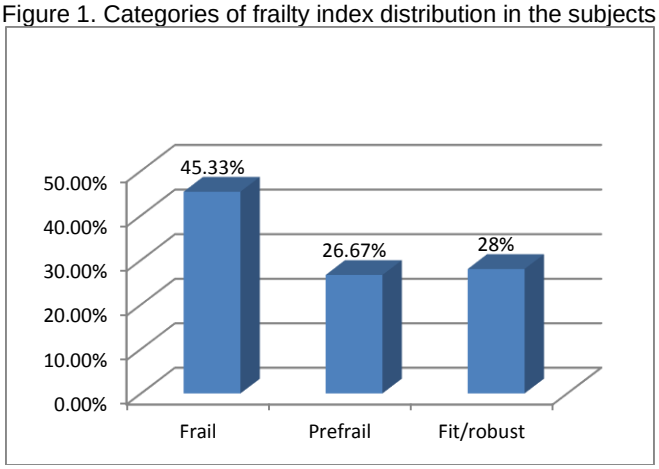
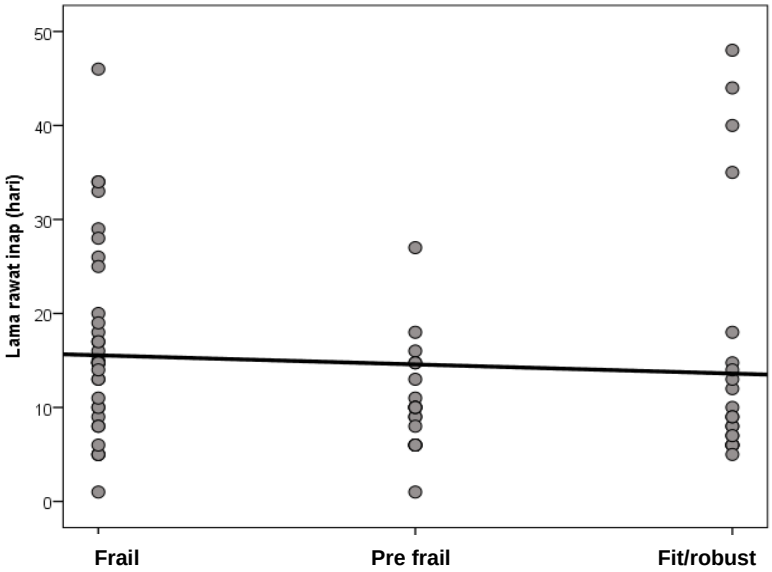


Figure 2.Association between FI categories and length of stay (n=71)



DISCUSSION

The study showed that most subjects were in the frail category (47.9%), followed by the prefrail (28.2%) and fit/robust (23.9%). Frail in this study was higher compared to a previous study done by Setiati et al.[6] with frail of 25.2%, prefrail of 61.6% and fit/robust of 13.2%. The incidence remained higher compared to the Malaysian population with frail of 8.9% and pre frail of 61.7%[7]. The difference in the frailty maybe caused by the difference in the subject resources. This study's subjects were inpatients in Geriatric wards and Rajawali wards in Dr. Kariadi General Hospital which was a referral hospital in the province. The study by Setiati et al. chose subjects from geriatric clinic and several hospitals in Indonesia, while Badrasawi et al. in Malaysia's subjects were from the elderly population in the rural and urban areas in Malaysia's cities.[6,7] Frailty in this study was close to that of elderly population hospitalized in Vietnam with 53.4% frail, 40.1% prefrail, and 24.5% fit/robust.[8] Frailty is a biological syndrome of the decline of body endurance and reserve towards stressors due to decreased physiological system resulting in susceptibility for bad outcomes including fall, hospital care, rehospitalisation, disability, or death.[9]

Bivariate analysis showed that there were 3 factors significantly correlated with frailty index, which were the cognitive function impairment, depression and dependency in daily life. The multivariate analysis showed that only dependency in daily life was significantly correlated with frailty index.

Frailty and cognitive function impairment increase along with age. A ten-year prospective cohort done by Raji et al.[10] showed that subjects with cognitive impairment had risks for frailty. A previous study in the elderly women showed that subjects with cognitive impairment in a 6-year follow up showed weakness in muscle performance and gait and slow walking.[11] A cross-sectional study in 2 cohorts showed a significant association between cognitive impairment and depression with frailty.[12] Frailty itself was further associated with cognitive function decline and cognitive impairment. A previous cohort study showed that 40% subjects with frailty had cognitive impairment. Frailty was associated with global decline in the function and cognitive function components e.g. episodic memory, semantic memory, working memory, perception and visuospatial abilities.[13] Cognitive impairment and frailty have associated risk factors. Neuronal infarction and high levels of proinflammatory cytokines e.g. tumor necrosis factor alpha (TNF-α), interleukin-6 (IL-6) and C-reactive protein (CRP) are factors associated with cognitive impairment and frailty.[10]

The previous studies showed that there was a reciprocal association between cognitive impairment and frailty. Cognitive impairment is a risk factor for upcoming frailty and the presence of frailty itself is associated with cognitive impairment. Therefore cognitive function and frailty are strongly associated. The study in the elderly living in the society showed that frailty and cognitive function were good predictors for poor health outcomes. This might be because each frailty and cognitive impairment was an independent predictor for declined functions in the elderly without disabilities living in society.[14]

The next factor significantly associated with frailty was depression. The study showed that 20% of the subjects with frailty suffered from depression. This number was lower compared to the previous meta-analysis in the geriatric hospitalized population that was 38.6%. This might be caused by the difference methods to measure depression and frailty. Frailty and depression are the main problem in the geriatric population. Depression syndrome in geriatric population is most of the times difficult to assess clinically. Depression and frailty often show similar symptoms, for example the low rate of daily activities may be because of the declines in energy (which may happen in both frailty and depression) and the loss of interest (anhedonia in depression) or the inability to do daily activities (disability). Frailty and depression are two different conditions but interchangeable in the clinical features.[6] A review of studies using different measuring depression and frailty still showed an association between the two conditions.[15] Depression is associated with cognitive impairment, both may contribute to frailty. This may be caused by the same risk factors and shared pathophysiological pathways. This reciprocal relationship is partly explained by the interchangeable mechanism such as vascular blockage, chronic inflammation, oxidative stress, mitochondrial dysfunction, and impairment in the hypothalamus pituitary-adrenal axis.[16] Subclinical disease in the vascular resulting in the hyperintesity in prefrontal cortex in patients with depression is one of key factors in prefrailty.[17]

Recent studies showed a positive correlation between frailty and proinflammatory cytokines such as IL-6 which is known to be increased in the geriatric patients with depression. Proinflammatory cytokines are associated with declines in strength and muscle mass. Besides, the cytokines are related to the declines in dopaminergic function of the central nervous system which may cause depressed affect, fatigue, delays in cognitive and motoric function.[18] Mitochondrial dysfunctions oftenly found in neurodegenerative disorders are also found in depression. Muscle tissue biopsy in patients with depression showed decreased ATP production. In patients with depression internal respiratory disorder, the mitochondria disfunction was found which was associated with fatigue.[18] Dysfunctions in the HPA axis result in dysregulations in the growth factors, insulin and testosterones. This may be found in both patients with depression and frailty, leading to a reciprocal relationship between depression and frailty.[19]

The next factor associated with frailty in the study was independence status. Multivariate analysis showed independence status is a factor associated significantly with frailty. In the study, all subjects with frailty are dependent. This might be caused by subjects were geriatric hospitalized patients. A study done in the elderly living in the society showed 14% dependence.[20] Dependence and frailty were reported to be the main predictors for mortality in the elderly population in Cuba. Subjects with frailty and dependence in the baseline had three-fold risk to death.[20]

Frailty status had no association with discharge status. A previous cohort study showed that frailty was a risk factor for mortality in a 4-year follow up.[21,22] The subjects in the study were hospitalized geriatric patients with mortality rate of 14.7% from all subjects and most subjects were discharged alive with improvements. A good management of co-morbidity resulted in the more number of subjects who discharged alive rather than the dead patients. The study did not follow up the lives after hospital discharge so the true frailty-induced mortality rate cannot be measured.

Frailty status in the study was significantly associated with length of hospital stay. This result is similar to a previous study which also found a significant association between frailty and length of hospital stay.[23,24] Frailty resulted in being more susceptible for diseases on the subjects. This was shown in the number of co-morbidities, in which the frail subjects had more co-morbidities compared to the fit/robust subjects. Presence of co-morbidities was associated with the complexity of the management demanding a longer period of hospital care.

Limitations of the study were the absence of follow ups after hospital discharge so outcomes of frailty-based care had not been assessed. Besides, subjects in the study was relatively small and only taken from a single hospital warranting a further study which is multicentre with a bigger subject size to gain a better generalization on risk factors for frailty and their impacts on the outcomes of geriatric hospitalized patient management and aftercare.

CONCLUSIONS

Frailty status in hospitalized geriatric patients in a hospital in Semarang were affected by independence status of daily life, depression status, and cognitive function status. There was no association between frailty index and discharge status of geriatric patients. Frailty status was associated with the length of stay; the higher the frailty status, the longer the hospital stay of the geriatric patients. The study also showed that cognitive function disorder, depression and dependency were factors associated with frailty while frailty itself is a dynamic process. Hence the geriatric care of the patients warrants more comprehensive preventions and management for those three factors.

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