

Factors Related with Handgrip Strength in Elderly Patients

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ABSTRAK

Latar belakang: proses penuaan menyebabkan penurunan fungsi pada berbagai organ. Otot rangka merupakan salah satu organ yang dipengaruhi oleh proses penuaan. Hal ini dikenal sebagai sarkopenia. Sarkopenia didefinisikan sebagai suatu sindroma yang ditandai oleh hilangnya massa dan kekuatan otot secara progresif. Pemeriksaan kekuatan genggam tangan seringkali diterapkan sebagai teknik penapisan sarkopenia. Penelitian ini bertujuan untuk menentukan hubungan usia, status gizi dan penyakit kronik seperti stroke, hipertensi (HT), diabetes melitus (DM), penyakit jantung koroner (PJK) dan penyakit paru obstruktif kronik (PPOK) dengan kekuatan genggam tangan. **Metode:** ini adalah studi potong lintang untuk menentukan faktor-faktor yang berhubungan dengan kekuatan genggam tangan pada pasien usia lanjut. Penelitian dilaksanakan di poliklinik Geriatri, Rumah Sakit Cipto Mangunkusumo dan Rumah Sakit Mohammad Hoesin sejak Agustus hingga Oktober 2015. Terdapat 352 subjek yang memenuhi kriteria penelitian ini dan direkrut dengan teknik pengambilan sampel secara berurutan (consecutive sampling). Variabel-variabel independen penelitian ini terdiri atas usia, jenis kelamin, status gizi, penyakit kronik (stroke, hipertensi (HT), diabetes melitus (DM), penyakit jantung koroner (PJK) dan penyakit paru obstruktif kronik (PPOK) dan lingkaran pinggang; sedangkan variabel dependen adalah kekuatan genggam tangan. **Hasil:** usia >75 tahun dan malnutrisi merupakan faktor risiko yang mempengaruhi lemahnya kekuatan genggam tangan. Usia >75 tahun akan meningkatkan risiko rendahnya kekuatan genggam tangan sebanyak 2-3 kali lipat. Malnutrisi meningkatkan risiko rendahnya kekuatan genggam tangan sebanyak 1,9 kali. **Kesimpulan:** usia >75 tahun dan malnutrisi akan meningkatkan faktor-faktor risiko menurunnya kekuatan genggam tangan pada pasien usia lanjut.

Kata kunci: kekuatan genggam tangan, usia lanjut, faktor.

ABSTRACT

Background: the aging process causes decreasing in the function of various organs. Skeletal muscle is one of the organs affected by aging process. It is known as sarcopenia. Sarcopenia is defined as a syndrome characterized by progressive loss of muscle mass and strength. The handgrip strength examination is often applied as a sarcopenia filtering technique. This study aimed to determine the relationship between age, nutritional status, and chronic diseases such as stroke, hypertension (HT), diabetes mellitus (DM), coronary heart disease (CHD), and chronic obstructive pulmonary disease (COPD) with handgrip strength. **Methods:** a cross-sectional study to determine factors related to the handgrip strength in elderly patients was conducted in Geriatric outpatient clinic of Cipto Mangunkusumo Hospital and Mohammad Hoesin Hospital from August to October 2015. There were 352 eligible subjects in this study recruited with consecutive sampling. The independent variables in the study consisted of age, sex, nutritional status, chronic disease (stroke, hypertension (HT), diabetes mellitus (DM), coronary heart disease (CHD) and chronic obstructive pulmonary disease (COPD)), waist circumference while

the dependent variable was handgrip strength. **Results:** age of more than 75 years old and malnutrition were risk factors that affected handgrip strength. Age of >75 years increase the risk for having low handgrip strength by 2,3-fold. Malnutrition increased risk for low handgrip strength for 1,9-fold. **Conclusion:** ages of >75 years old and malnutrition will increase the risk of low handgrip strength in elderly patients.

Keywords: handgrip strength, elderly, factor.

INTRODUCTION

The elderly population in the world is predicted increase by three-fold within 50 years, from 600 million people in 2000 to over two billion in 2050. The number of elderly population in Indonesia is ranked the top five in the world, reaching 18.1 million in 2010 and is estimated increase by two-fold to 36 million in 2025. Life expectancy of the population Indonesia (both male and female) reached 67.8 years in 2000-2005 and is predicted increase to 73.6 years in 2020-2025.^{1,2} The increasing elderly population is accompanied by increasing health problems as one of the effects of the aging process. The aging process is associated with decreasing function of various organs. Skletal muscle is one of the organs affected by aging, which is well known as sarcopenia.

Sarcopenia is a syndrome characterized by progressive loss of muscle mass and strength.³⁻⁵ The Prevalence of sarcopenia in the age of 60 to 70 years old was reported from 5% to 13% while in those aged >80 years is 11% to 50%. For the time being, the total number of sarcopenia cases is estimated to have reached at least 50 million cases, and in the period of 40 years the number can soar up to 200 million.⁶

A loss in muscle mass and strength would affect physical performance, functional status, mobility, the occurrence of impairment as well as increase the risk of death. Decreasing muscle strength occurs more rapidly than that of the muscle mass. The loss of muscle strength can not be prevented by maintaining or increasing muscle mass.^{7,8} Muscle strength can be measured on the upper and lower extremities with a dynamometer. There is a correlation between hand grip strength and muscle strength in other body parts. The handgrip strength examination is often applied as a sarcopenia filtering technique in clinical setting such measurement is considered

inexpensive, simple, easy, and can be done with portable measuring tool. Hand grip examinations conducted with Jamar dynamometers warrant a higher accuracy rate and greater force than any other measuring tools, hence Jamar dynamometers are more commonly used.⁹

Putrawan¹⁰ found a positive relation between waist circumference and hand grip strength. Meanwhile, Keevil et al.¹¹ demonstrated a negative relationship between waist circumference and handgrip strength as well as the relationship between body mass index (BMI) and waist circumference. However, controversies are still rife when it comes to the relation between BMI and hand grip strength as described by Silva et al.,¹² while Westrop et al.¹³ found the relationship between BMI and grip strength was to be weak. On the other hand, a contrasting result reported by Kamarul¹⁴ showed that the hand grip strength was not related with BMI. The BMI assessment is a crucial part of Mini Nutritional Assessment (MNA) examination. MNA is an effective instrument to assess the nutritional status of elderly. Moreover, a study by Rantanen¹⁵ showed that there was a relation between hand grip strength and chronic diseases such as stroke, hypertension (HT), diabetes mellitus (DM), coronary heart disease (CHD), and chronic obstructive pulmonary disease (COPD). This study aimed to determine the relationship between age, nutritional status, and chronic diseases such as stroke, hypertension (HT), diabetes mellitus (DM), coronary heart disease (CHD), and chronic obstructive pulmonary disease (COPD) with handgrip strength.

METHODS

This was a cross-sectional study to determine factors related to handgrip strength in elderly patients, conducted in Geriatric outpatient clinic of Cipto Mangunkusumo Hospital and

Mohammad Hoesin Hospital from August to October 2015. The inclusion criteria were patients aged above 60 years old with comorbidity of chronic diseases. Exclusion criteria were cognitive deficits (abbreviated mental test of <8), depression (geriatric depression scales of >10), and acute condition of diseases. There were 352 eligible subjects in this study recruited with consecutive sampling. The independent variables in the study consisted of age, sex, nutritional status, chronic disease (stroke, hypertension (HT), diabetes mellitus (DM), coronary heart disease (CHD) and chronic obstructive pulmonary disease (COPD)), waist circumference while the dependent variable was handgrip strength.

The collected data was processed with SPSS 20 for windows. Descriptive data was presented in the forms of text, tables, and images as appropriate. The bivariate analysis for categorical variables was done with chi-square analysis. The prevalence rate was displayed in the form of proportion (percentage) with its 95% of confidence intervals. Variables with $p < 0.25$ in the bivariate analysis would be incorporated into the multivariate analysis. The multivariate analysis

was performed with Cochran Mantel Haenzel analysis. Numerical data was analyzed with t-test.

This study had been approved by the Ethical Committee of Faculty of Medicine Universitas Indonesia/Cipto Mangunkusumo Hospital on July 6th, 2015 (573/UN2.F1/ETIK/2015).

RESULTS

There were 352 eligible subjects in this study and the percentage of every variables is presented on **Table 1**.

Table 2 shows factors related to handgrip strength in elderly patients. Age of >75 years old and malnutrition were the risk factors that were found to affect handgrip strength. Age of >75 years increased risk for low handgrip strength by 2.3-fold, while malnutrition increased the risk for low handgrip strength by 1.9-fold.

DISCUSSION

This study has obtained the relationship between age and the decrease of handgrip strength (PR 1.7; 95% CI 1.4 to 2.2). The results of this study was consistent with that of Forrest et al.¹⁶ and Budziareck¹⁷ which showed that decreasing muscle strength began to occur at the age of 50 years old. Decreasing handgrip strength in the elderly is associated with their fiber-type transformation, shifts in muscle fiber architecture and the process of Excitation-Contraction (EC) coupling, genetic factors, and oxidative stress (such as the increase in IL-6 and proapoptotic cytokines TNF- α).¹⁸ However, the decreasing muscle fiber type II which plays an important role in anaerobic metabolism (i.e. glycolysis is high) is believed to be the main mechanism that initiates the declining muscle strength.¹⁹

The assessment of nutritional status with MNA in the study had showed a significant association with handgrip strength ($p < 0.001$). The result was in line with the study by Karbarugi et al.²⁰ which showed the correlation between MNA score and handgrip strength ($r = 0.47$, $p < 0.001$). Despite many of the instruments utilized to assess the nutritional status such as BMI (body mass index), subjective global assessment, and the patient generated-subjective global assessment (PG-SGA); MNA remains to be a reliable instrument. Decreasing muscle

Table 1. Baseline characteristics (n=352)

Variables	Values
Sex, n (%)	
- Woman	212 (60.2)
- Men	140 (39.8)
Age (years), mean (SD)	69.7 (6.3)
Age group, n (%)	
- ≤ 75	267 (75.9)
- > 75	85 (24.1)
Waist circumference (cm), mean (SD)	90.6 (10.7)
Nutritional status, n (%)	
- Normal	304 (86.4)
- Malnutrition	48 (14.6)
Comorbidity, n (%)	
- Hypertension	277 (78.7)
- Diabetes mellitus	156 (44.3)
- Coronary heart disease	84 (23.9)
- Stroke	30 (8.5)
- COPD	15 (4.3)
Handgrip strength (Kg), mean (SD)	
- Woman	19.8 (5.1)
- Men	29.1 (6.9)

Table 2. Factors related handgrip strength

Variables	Handgrip Strength, n (%)		Prevalence Ratio (CI 95%)	Adjusted Prevalence Ratio (CI 95%)	P
	Low	Normal			
Aged (years)					
- > 75	48 (56.5)	37 (43.5)	1.7 (1.4-2.2)*	2.3 (1.7-2.9)#	0.001
- ≤ 75	67 (25.1)	200 (74.9)			
Waist circumference (cm), mean (SD)	90,8 (11.3)	90,5 (10.4)			0.8**
Nutritional Status					
- Malnutrition	27 (56.2)	21 (43.8)	1.6 (1.2-2.3)*	1.9 (1.4-2.6)#	<0.001
- Normal	88 (28.9)	216 (71.1)			
Hypertension					
- Yes	90 (32.5)	187 (67.5)	0.9 (0.6-1.7)*		0.6
- No	25 (33.3)	50 (66.7)			
Diabetes mellitus					
- Yes	53 (34.0)	103 (66.0)	1.0 (0.9-1.2)*		0.6
- No	62 (31.6)	134 (68.4)			
Coronary heart disease					
- Yes	22 (26.2)	62 (73.8)	0.9 (0.8-1.0)*		0.1
- No	93 (34.7)	175 (65.3)			
Stroke					
- Yes	11 (36.7)	19 (63.3)	1.08 (0.7-1.7)*		0.748
- No	104 (32.3)	218 (67.7)			
COPD					
- Yes	5 (33.3)	10 (66.7)	1.0 (0.7-1.5)*		0.9
- No	110 (32.6)	227 (67.4)			

*Chi square test, # Cochran Mantel Haenzel, **T test

strength in malnourished condition is due to decreasing muscle protein supply which is a useful alternative energy source.²¹

The aging process is associated with changes in quantitative and qualitative motor cortex and bone marrow. The aging process is caused by reduced neurotrophic factors such as serotonergic, cholinergic, adrenergic, dopaminergic, γ -aminobutyric acidergic and glutamatergic system. The change will cause a state of hypoexcitability in the cortex, reduced ability to braid the motor coordination, and reduction in cortical plasticity. It will affect the motor performance, especially in skeletal muscle strength.²² Denervation of type II fibers and the formation of collateral reinnervation to the motor unit type I (slow type) occurs in elderly patients. Some studies showed 57% decrease in muscle fiber type II and 25% decrease in muscle fiber type I. Myofibrils type II plays a pivotal role in type

2 anaerobic metabolism (i.e. glycolysis is high) for high voltage and short duration. Myofibrils type I plays a role in aerobic metabolism (i.e. higher oxidation).

CONCLUSION

Age of >75 years old and malnutrition will increase the risk of handgrip strength in elderly patients.

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