



Relation of physical function and physical activity to sarcopenia in hemodialysis patients: A preliminary study

Hotta, Chiharu ; Hiraki, Koji ; Wakamiya, Akiko ; Otobe, Yuhei ;
Watanabe, Satoshi ; Izawa, P. Kazuhiro ; Kaneshiro, Nagayuki ; Konno, ...

(Citation)

International Journal of Cardiology, 191:198-200

(Issue Date)

2015-07-15

(Resource Type)

journal article

(Version)

Accepted Manuscript

(Rights)

© 2015 Elsevier Ireland Ltd.

This manuscript version is made available under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International license.

(URL)

<https://hdl.handle.net/20.500.14094/0100495461>



2 Relation of physical function and physical activity to sarcopenia in hemodialysis
3 patients: A preliminary study
4

5 Chiharu Hotta, BSc,^a Koji Hiraki, MSc,^a Akiko Wakamiya, BSc,^b Yuhei Otobe, BSc,^a
6 Satoshi Watanabe, BSc,^a Kazuhiro P. Izawa, PhD,^{c,*} Nagayuki Kaneshiro, MD, PhD,^d
7 Yusuke Konno, MD, PhD,^d Tsutomu Sakurada, MD, PhD,^e Yugo Shibagaki, MD, PhD,^e
8 Kenjiro Kimura, MD, PhD^f
9

10 ^a Department of Rehabilitation Medicine, St. Marianna University School of Medicine
11 Hospital, Kawasaki, Japan

12 ^b Department of Rehabilitation Medicine, Kawasaki Municipal Tama Hospital,
13 Kawasaki, Japan

14 ^c Graduate School of Health Sciences, Kobe University, Kobe, Japan

15 ^d Division of Nephrology and Hypertension, Department of Medicine, Kawasaki
16 Municipal Tama Hospital, Kawasaki Japan

17 ^e Division of Nephrology and Hypertension, Department of Medicine, St. Marianna
18 University School of Medicine Hospital, Kawasaki, Japan

19 ^f Japan Community Health care Organization Tokyo Takanawa Hospital, Tokyo, Japan
20

21 * Corresponding author: Kazuhiro P. Izawa, PT, PhD, MSc

22 Graduate School of Health Sciences, Kobe University, 10-2 Tomogaoka 7-chomo Suma,

23 Kobe 654-0142, Japan

24 TEL: +81-78-796-4566

25 E-mail: izawapk@harbor.kobe-u.ac.jp

26

27 Keywords: Sarcopenia, Physical function, Physical activity, Hemodialysis patients

28

29 Sources of funding: None

30

Chronic kidney disease is an important risk factor for cardiovascular disease and mortality [1]. In hemodialysis (HD) patients, habitual physical activity (PA) among outpatients undergoing maintenance hemodialysis is associated with decreased mortality risk [2]. Sarcopenia is defined as the loss of skeletal muscle mass and strength that occurs with advancing age [3]. It also related to physical function, activities of daily living, and mortality in elderly people [3].

It would be of great interest to know the prevalence rate of sarcopenia and whether it is related to any differences in physical function and PA status in HD patients. However, sarcopenia in HD patients is not well studied.

We hypothesized that sarcopenia in patients undergoing HD might be related to reduced physical function and PA. Therefore, the purposes of the present study were to evaluate 1) the prevalence rate of sarcopenia in patients with HD and 2) the relation of differences in physical function and PA to sarcopenia in HD patients.

This cross-sectional study comprised 33 consecutive outpatients undergoing HD who could walk under their own power to St. Marianna University School of Medicine Hospital. Patients with neurological or orthopedic disease, dementia, and those who required help to walk were excluded from this study.

Patient characteristics were evaluated by review of medical records and included age, sex, body mass index, duration of HD, primary kidney disease, and history of diabetes mellitus, nephrosclerosis, and other disease. Biochemical parameters measured included serum albumin, hemoglobin, and C-reactive protein. The St. Marianna University School of Medicine Institutional Committee on Human Research approved this study

(Approval number: 1965), and informed consent was obtained from each patient.

Physical function was evaluated by measurement of handgrip strength (kgf), knee extensor muscle strength (kgf/kg), one-leg standing time (sec), and gait speed (m/sec) as described in a previous study [4].

The average daily number of steps taken was used as the index of PA and was determined with the Kenz Lifecorder EX 1-axial accelerometer (Suzuken Co., Ltd., Nagoya, Japan). All subjects wore the accelerometer continuously for 9 days on a belt at waist level just above either leg. The final 7 days of continuous data recorded over the 9-day collection period were used to assess the patient's usual daily PA. The average daily number of steps taken was calculated as total step count over 7 days / 7.

A multifrequency bioelectrical impedance machine (InBody 720; Biospace, Tokyo, Japan) was used to estimate muscle mass, which was measured by a bioelectrical impedance analysis method. The skeletal muscle index (SMI) was calculated as follows: $SMI = \text{lean muscle mass} / \text{height}^2$. Sarcopenia was defined based on the algorithm of the European Working Group on Sarcopenia in Older People, and the patients were accordingly divided into two groups: the sarcopenia group and the non-sarcopenia group [3].

Results are expressed as mean $\pm$ standard error (SE). The prevalence rate of sarcopenia was calculated as follows: number of patients with sarcopenia/33 patients $\times$ 100 (%). Data were analyzed using the Mann-Whitney U test, chi-squared test, and one-way analysis of covariance. A *P* value of <0.05 was considered to indicate statistical significance. Statistical analyses were performed with IBM SPSS 17.0 J statistical

software (IBM SPSS Japan, Inc., Tokyo, Japan).

Of the 33 patients, 14 patients had sarcopenia (sarcopenia group) and 19 patients did not (non-sarcopenia group), resulting in a prevalence rate of sarcopenia of 42.2%.

Although the percentage of male patients tended to be higher than that of the female patients, there were no significant differences in patient characteristics between the two groups (Table 1). There were, however, significant differences in the levels of hemoglobin and C-reactive protein, but not of serum albumin, between the two groups (Table 1).

With regard to handgrip strength, knee extensor muscle strength, one-leg standing time and gait speed of physical function parameters, average number of steps per day of PA, Hb and SMI in the sarcopenia group were all significantly lower than those in the non-sarcopenia group (Table 1, Figure 1).

This is the first study, to our knowledge, to report that physical function parameters, average number of steps per day of PA, Hb and SMI were significantly lower in HD patients with sarcopenia than in those without sarcopenia. Yamada et al. [5] reported that the prevalence rates of sarcopenia, as determined by the algorithm suggested by the European Working Group on Sarcopenia in Older People, in community-dwelling older Japanese men and women aged 65 to 89 years were 21.8% and 22.1%, respectively. The prevalence of sarcopenia in the HD patients in the present study (42.2%) was higher compared with that in the Yamada et al. study.

Sarcopenia is closely associated with such factors as inflammatory markers,

depression, and cognitive dysfunction [6]. In the present study, the level of C-reactive protein, a biomarker of inflammatory reaction, was significantly higher in the sarcopenia group than in the non-sarcopenia group, which supports the finding from the previous study [6].

However, in the present study, knee extensor muscle strength and one-leg standing time of physical function parameters, average daily steps of PA and Hb in the sarcopenia group were also significantly lower than those in the non-sarcopenia group. It was thus revealed that when comparing the HD patients with and without sarcopenia, knee extensor muscle strength and one-leg standing time of physical function parameters as well as average daily steps of PA and Hb, which so far have not been used as diagnostic criteria, were clearly decreased in the patients with sarcopenia.

Limitations in the present study include its small sample size and that sex-related differences could not be evaluated.

In conclusion, in HD patients with sarcopenia, handgrip strength, knee extensor muscle strength, one-leg standing time and gait speed of physical function parameters, average daily steps of PA, Hb and SMI may be negatively affected compared with those in HD patients without sarcopenia.

References

1. A.S. Go, G.M. Chertow, D. Fan, C.E. McCulloch, C.Y. Hsu, Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization, *N. Engl. J. Med.* 351 (2004) 1296-1305.
2. R. Matsuzawa, A. Matsunaga, G. Wang, et al., Habitual physical activity measured by accelerometer and survival in maintenance hemodialysis patients, *Clin. J. Am. Soc. Nephrol.* 7 (2012) 2010-2016.
3. A.J. Cruz-Jentoft, J.P. Baeyens, J.M. Bauer, et al., Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People, *Age Ageing.* 39 (2010) 412-423.
4. K.P. Izawa, S. Watanabe, K. Oka, Relationship of thresholds of physical performance to nutritional status in older hospitalized male cardiac patients, *Geriatr. Gerontol. Int.* 15 (2015) 189-195.
5. M. Yamada, S. Nishiguchi, N. Fukutani, et al., Prevalence of sarcopenia in community-dwelling Japanese older adults, *J. Am. Med. Dir. Assoc.* 14 (2013) 911-915.
6. J.K. Kim, S.R. Choi, M.J. Choi, et al., Prevalence of and factors associated with sarcopenia in elderly patients with end-stage renal disease, *Clin. Nutr.* 33 (2014) 64-68.

Figure Legend

Fig. 1. Differences in physical function parameters between the sarcopenia and non-sarcopenia groups. Hand grip strength, gait speed, knee extensor muscle strength, one-leg standing time, average steps/day of PA, and SMI in the sarcopenia group were all significantly lower than those in the non-sarcopenia group. PA, physical activity; SMI, skeletal muscle index.

■ Sarcopenia
□ Non-sarcopenia

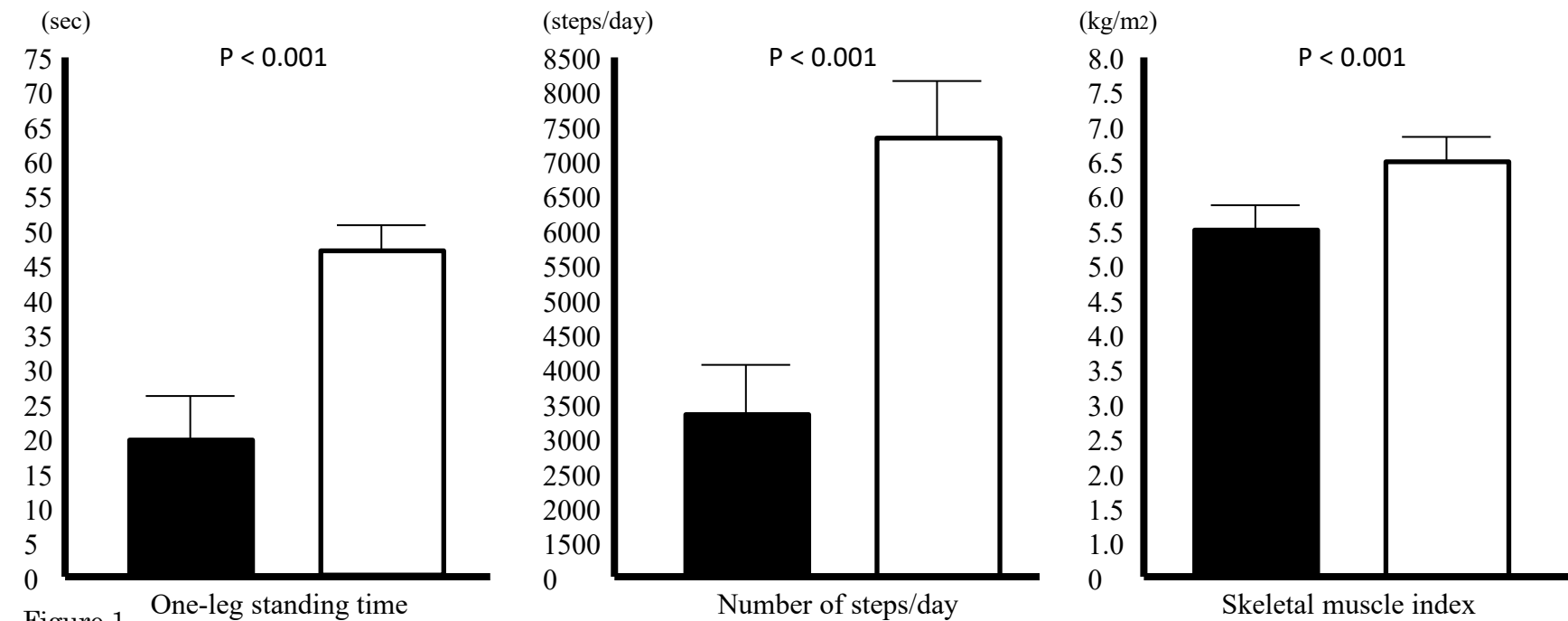
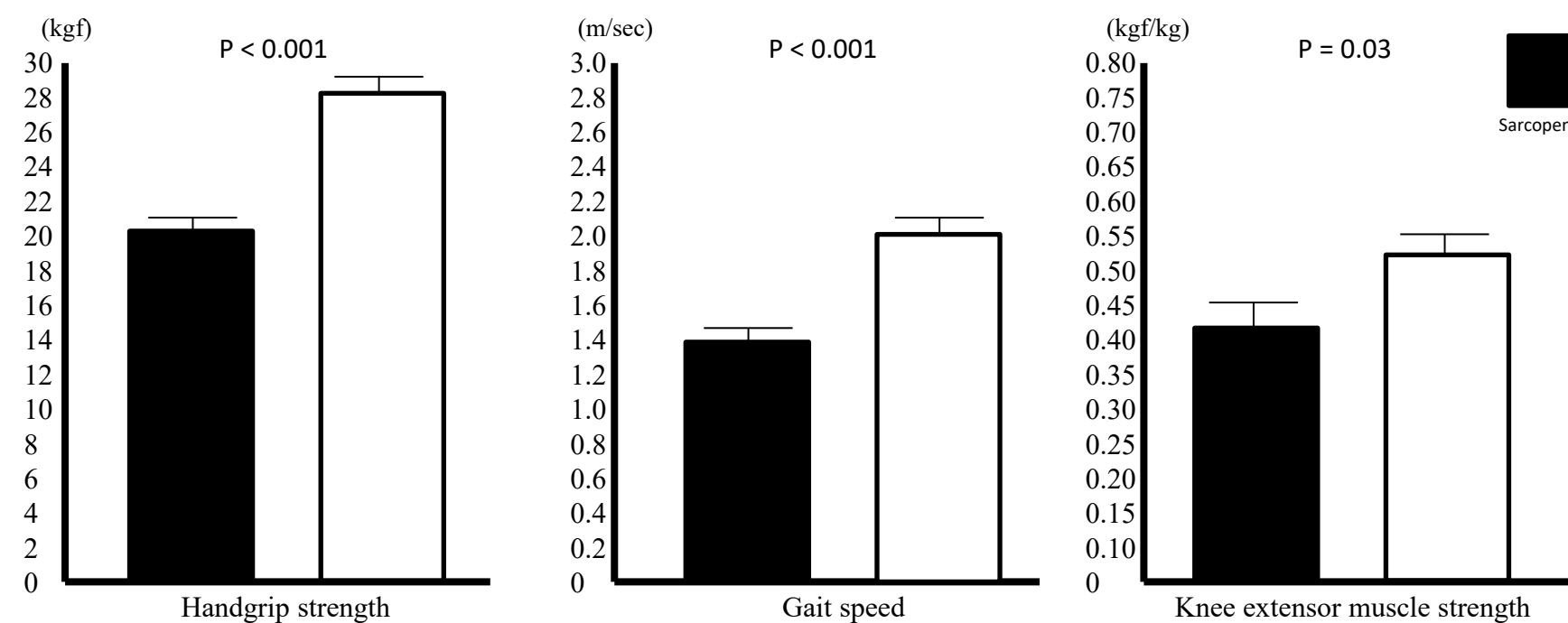


Figure 1

Table 1

Patient characteristics, physical function, physical activity, and skeletal muscle index

	Sarcopenia group n=14	Non-sarcopenia group n=19	F, Z, χ^2 values	P value
Age (yrs)	70.5 $\pm$ 2.2	65.5 $\pm$ 2.4	-1.35	0.19
Sex (male, %)	78.6	47.4	3.29*	0.07
BMI (kg/m ²)	21.3 $\pm$ 0.8	21.8 $\pm$ 0.9	-0.35	0.73
Duration of hemodialysis (months)	53.3 $\pm$ 5.5	50.1 $\pm$ 8.8	-0.32	0.81
Primary kidney disease (n)				
DM/nephrosclerosis/other	4/3/7	4/6/9	0.50*	0.78
Biochemical parameters				
Hemoglobin (mg/dl)	10.7 $\pm$ 0.3 (10.2-11.3)	11.7 $\pm$ 0.2 (11.2-12.2)	6.39	0.02
Serum albumin (mg/dl)	3.9 $\pm$ 0.1 (3.8-4.1)	3.8 $\pm$ 0.7 (3.7-4.0)	0.95	0.34
C-reactive protein (mg/dl)	0.5 $\pm$ 0.1 (0.2-0.8)	0.1 $\pm$ 0.1 (0.2-0.3)	4.89	0.04
Physical function				
Handgrip strength (kgf)	20.2 $\pm$ 1.1 (17.9-22.6)	27.8 $\pm$ 1.0 (25.8-29.8)	24.31**	<0.001
Gait speed (m/sec)	1.4 $\pm$ 0.1 (1.2-1.5)	2.0 $\pm$ 0.1 (1.8-2.1)	25.72**	<0.001
Knee extensor muscle strength (kgf/kg)	0.42 $\pm$ 0.03 (0.35-0.48)	0.52 $\pm$ 0.03 (0.47-0.58)	5.56**	0.03
One-leg standing time (sec)	20.5 $\pm$ 5.6 (9.0-32.0)	45.9 $\pm$ 4.8 (36.1-55.7)	11.27**	<0.001
Number of steps/day (steps)	3269.8 $\pm$ 964.7 (1299.7-5240.0)	7372.5 $\pm$ 821.5 (5694.7-9050.3)	9.98**	<0.001
Skeletal muscle index (kg/m ²)	5.6 $\pm$ 0.2 (5.2-6.1)	6.5 $\pm$ 0.2 (6.1-6.9)	9.24**	<0.001

Values are mean $\pm$ standard error (95% confidence interval); covariate: sex.

BMI; body mass index, DM; diabetes mellitus.

* χ^2 value, **F value.