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慢性血液透析患者を対象とした身体活動量評価における データ採用基準充足の特性

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Factors Related to Meeting Data Recruitment Criteria for Physical Activity Measurements in Patients on Chronic Hemodialysis

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要旨

【はじめに】

我が国における透析患者数は年々増加し、患者の高齢化も進んでいる。そのため、透析導入後の QOL および生存率の改善が課題である。

我々は、これまで、慢性血液透析（Chronic Hemodialysis、CHD）患者を対象として、身体活動量や座位行動が健康関連 QOL の重要な規定要因であることを報告してきた。また、健康づくりのために身体活動量を増加させることが有意義であることが広く知られている。身体活動量の評価方法として、妥当性や信頼性が証明されている３軸加速度計が用いられている。

CHD 患者は、血液透析治療を行う透析日と治療を行わない非透析日があり、活動量計の装着日数や１日あたりの装着時間が十分ではない場合が多く、習慣的な身体活動量を評価することが困難である。

【目的】

本研究では、慢性血液透析患者を対象に、３軸加速度計を用いた身体活動量測定の採用基準を満たす患者特性について検討した。

【対象】

対象は、2013 年から 2018 年に因島総合病院の透析センターに通院する慢性血液透析患者 196 名の血液透析患者のうち、採用基準を満たした 132 名（男性 77 名、女性 55 名、平均年齢 71.1 ± 10.0 歳）を解析対象とした。

【方法】

評価項目は、性別、年齢（歳）、身長（cm）、体重（kg）、BMI（kg /m^2）、透析歴（年）、透析原因（糖尿病腎症 / その他）、血液透析導入年齢（歳）、血液データとして、アルブミン（g/mL）、空腹時血糖（mg/dL）、中性脂肪（mg/dL）、HDL コレステロール（mg/dL）および慢性疾患（糖尿病、高血圧症、脂質異常症、腰痛、膝痛）を身体活動量測定の初回参加時の最新の情報を個人カルテより収集した。

身体活動量は、３軸加速度計内蔵身体活動量計（Active style Pro HJA-350IT、オムロン社）を用いて評価した。採用基準は、連続した 14 日のうち、１）１日あたり 600 分以上の装着、２）３日の透析日と日曜日を含めた４日の非透析日を合わせた７日間のデータが揃っている、とした。また、採用基準を満たした群（SG 群）と満たせなかった群（USG）に分類し、２群間における評価項目について、χ 二乗検定を用いた。また、多重ロジスティック回帰分析を用いて、身体活動量評価の採用基準充足の有無に関連する因子について、性別、年齢、体格指数、透析歴、透析原因疾患を調整因子と

して検討した。

参加者には、紙面にてインフォームドコンセントを得ており、本研究は、因島総合病院研究倫理委員会の承認を得て実施した。

【結果および考察】

性別、脂質異常症、膝痛において、SG 群と USG 群間に有意差を認めた。ロジスティック回帰において、性別が身体活動評価の採用基準充足に関与しており、男性が女性よりも有意にオッズ比が低値を示した（オッズ比：0.39、95%CI：0.18-0.84）。本研究結果より、CHD 患者の身体活動量調査では、充足者の特性として性別が関連しており、男性への働きかけに配慮することで充足率が改善する可能性が示唆された。

【結論】

慢性血液透析患者において、身体活動量評価基準の充足には、性別が関与す可能性が示唆された。

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Introduction

The number and age of patients on chronic hemodialysis (CHD) are increasing in Japan. Therefore, effective prevention and maintenance strategies for patients on CHD have become a public health challenge, and increases in lifespan with better health-related quality of life (QOL) are expected.

We previously reported that daily physical activity [1, 2] and sedentary behavior [3] were important factors affecting health-related QOL in patients on CHD. A tri-accelerometer, which has high reliability and validity [4, 5], has recently been used to evaluate physical activity, including sedentary behavior [6-8]. The evaluation of physical activity using a tri-accelerometer is generally performed over 7 continuous days, and average physical activity per day is analyzed [9]. Therefore, this evaluation is affected by the number of days as well as time per day that the device is worn, which may induce bias [10].

Patients on CHD have to lie in a supine position for at least 4 hours per day and 3 times per week to undergoing HD treatment. Physical activity is usually evaluated in patients on CHD as follows: 1) days with at least 600 minutes of wearing time are considered valid, and 2) patients with at least 7 valid days (more specifically, 3 HD days and 4 non-HD days including Sunday) are included in the evaluation [3]. However, difficulties are associated with physical activity measurements in patients on CHD because HD days, non-HD days, and total days (7 days) need to be considered [11]. We previously reported that the adoption rate of a 7-day physical activity evaluation on HD days (3 days), non-HD days, including Sunday (4 days), and total days was low (48.4%) [3]. To accurately and effectively evaluate physical activity including sedentary behavior in patients on CHD, clinical characteristics need to be compared between those who do and do not meet data recruitment criteria using a tri-accelerometer.

In the present study, we investigated clinical characteristics related to meeting data recruitment criteria for physical activity measurements using a tri-accelerometer in patient on CHD.

Subjects and Methods

Subjects

Among 196 outpatients on CHD in Innoshima General hospital between 2013 and 2018, 64 subjects were excluded due to disagreement (n=43), not implemented (n = 11), and lack of data (n = 10), and finally 132 subjects (77men, 71.1 ± 10.0 years) were recruited for analysis in this cross-sectional study (**Figure 1**).

All subjects provided written informed consent. Ethical approval for the present study was obtained from the Ethics Committee at Innoshima General Hospital, Onomichi, Japan (H25.2.27, H26.1.23, H26.12.16, H27.12.25, H28.12.9, and H29.12.4).

Clinical parameters and measurements

The following clinical parameters were obtained from medical clinical records: sex, age (years), height (cm), body weight (dry weight) (kg), body mass index (kg/m^2), the duration of HD (years), cause of HD (diabetic nephropathy or others), age at the initiation of HD (years), albumin (g/mL), fasting blood glucose (mg/dL), triglyceride (mg/dL), HDL-cholesterol (mg/dL), and the presence of chronic disease (diabetes mellitus, hypertension, dyslipidemia, low back pain, and knee pain), as described previously [3]. The

Table 1. Clinical characteristics of patients on chronic hemodialysis

Clinical parameters	
Women	55 (41.7)
Age (years)	71.1 ± 10.0
Older than 65 years	100 (75.8)
Height (cm)	156.2 ± 9.3
Body weight (dry weight) (kg)	54.6 ± 11.9
Body mass index (kg/m^2)	22.3 ± 3.7
Duration of HD (years)	5.4 ± 7.3
Diabetic nephropathy	47 (35.6)
Age at the initiation of HD (years)	66.1 ± 14.0
Blood samples	
Albumin (g/mL)	3.7 ± 0.4
Fasting blood glucose (mg/dL)	134.3 ± 40.4
Triglyceride (mg/dL)	114.3 ± 73.3
HDL-cholesterol (mg/dL)	53.9 ± 16.5
Chronic Diseases	
Diabetes mellitus	60 (45.5)
Hypertension	117 (88.6)
Dyslipidemia	54 (40.9)
Low back pain	43 (32.6)
Knee pain	20 (15.2)

Values are shown as the mean ± SD or *n* (%)
HD: hemodialysis

presence of chronic disease was established based on medical records. Clinical parameters were collected from the most recent medical records during the first participation of respective subjects in physical activity measurements using a tri-accelerometer.

A tri-accelerometer（Active style Pro HJA-350IT, OMRON HEALTH CARE Co., Ltd., Kyoto, Japan）, which has been widely used in assessments of physical activity with high reliability and validity [4, 5], was used to objectively evaluate physical activity in the present study. The adoption criteria for evaluating physical activity were as follows and described previously [3]: 1）days with at least 600 minutes of wearing time were considered valid, and 2）patients with at least 7 valid days（more specifically, 3 HD days and 4 non-HD days including Sunday）were included in the evaluation. Patients who satisfied adoption data recruitment criteria were allocated to the satisfied group（SG）, while those who did not were allocated to the unsatisfied group（USG）. We compared clinical parameters between the 2 groups.

Statistical analysis

Data were expressed as means ± standard deviation（SD）. Comparisons between the 2 groups were performed using the chi-squared test. A multiple logistic regression analysis was used to identify factors related to meeting data recruitment criteria in the evaluation of physical activity using the tri-accelerometer in patients on CHD. We used the group type as a dependent variable, and sex, age, body mass index, the duration of HD, and cause of HD as independent variable that were considered to be clinically important.

Statistical analyses were performed using JMP 13.0 software（SA, Cary, NC, USA）.

Results

Clinical characteristics are summarized in Table 1. Fifty-five（41.7%）patients were women and 100（75.8%）were older than 65 years. Age at the initiation of HD was 66.1 ± 14.0 years（**Table 1**）.

Table 2 shows a comparison of clinical parameters between SG（n = 57）and USG（n = 75）. The prevalence of women was significantly higher in SG than in USG. The prevalence of dyslipidemia and knee pain was also significantly higher in SG than in USG（**Table 2**）. No significant differences were observed in other clinical parameters between the 2 groups.

We used a multiple logistic regression analysis to identify factors related to meeting data recruitment criteria in the evaluation of physical activity using the tri-accelerometer in patients on CHD. Sex was found to

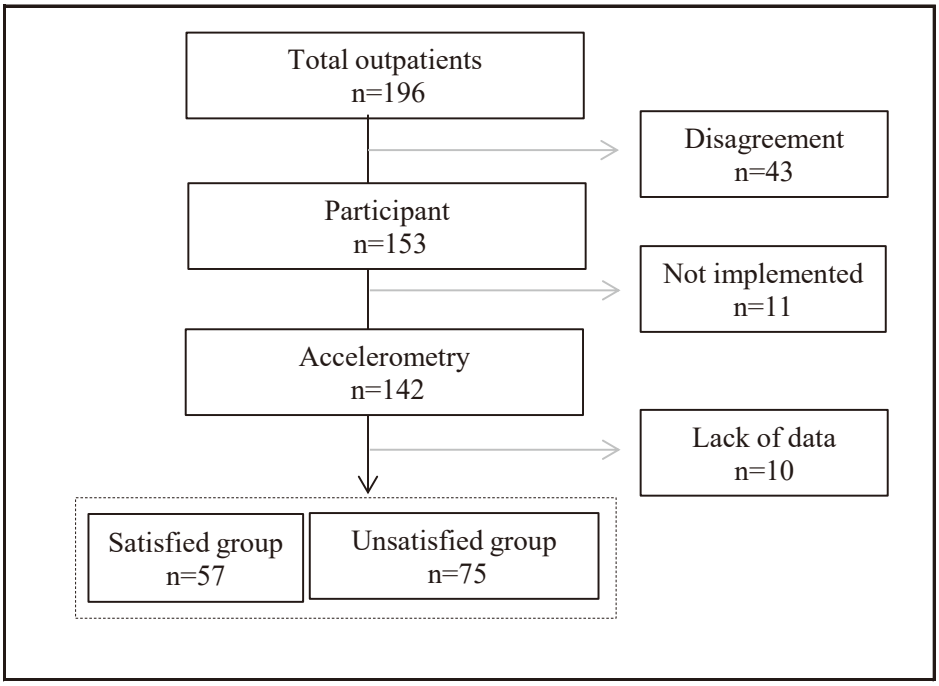

Figure 1. Flowchart of patients

be associated with meeting data recruitment criteria after adjustments for confounding factors [odds ratio: 0.39 (reference: women), 95% confidence interval: 0.18-0.84] (**Table 3**).

Discussion

In the present study, we investigated clinical characteristics related to meeting data recruitment criteria for physical activity measurements using a tri-accelerometer in patients on CHD. Sex was identified as a clinically important factor in meeting data recruitment criteria for physical activity measurements, and men showed a significantly lower odds ratio than women.

Several limitations remain in the present study. Subjects were older and patients in a single clinic in Onomichi, Japan; therefore, the results obtained cannot be generalized to patients on CHD. Furthermore, we did not conduct a stratified analysis using detailed data, i.e. the time per day and days per week that the device was worn by subjects who did not meet the data recruitment criteria for physical activity measurements using the tri-accelerometer.

In conclusion, sex was an important factor related to meeting data recruitment criteria for the tri-accelerometer in patients on CHD. Although we currently cannot clarify the reason for the sex difference in the present study, it needs to be considered when evaluating physical activity using a tri-accelerometer in patients on CHD. Furthermore, we need to strongly encourage patients to attach the tri-accelerometer in order to accurately evaluate physical activity, including sedentary behavior, particularly

Table 2. Comparison of clinical parameters in chronic hemodialysis patients in satisfied and unsatisfied groups

	Satisfied group	Unsatisfied group	*p* value
Number	57 (43.1)	75 (56.8)	
Sex			
Men	26 (45.6)	51 (68.0)	**0.010**
Women	31 (54.4)	24 (32.0)	
Age (years)			
< 65	11 (19.3)	21 (28.0)	
65 - 74	18 (31.6)	23 (30.7)	0.482
≥ 75	28 (49.1)	31 (41.3)	
Body mass index (kg/m^2)			
< 25	44 (77.2)	59 (78.7)	0.840
≥ 25	13 (22.8)	16 (21.3)	
Duration of HD (years)			
< 5	36 (63.2)	56 (74.7)	
5 - 10	7 (12.3)	9 (12.0)	0.239
≥ 11	14 (24.6)	10 (13.3)	
Cause of HD			
Diabetic nephropathy	20 (35.1)	27 (36.0)	0.914
Others	37 (64.9)	48 (64.0)	
Hypertension			
Yes	52 (91.2)	65 (86.7)	0.413
No	5 (8.8)	10 (13.3)	
Diabetes mellitus			
Yes	25 (43.9)	35 (46.7)	0.748
No	32 (56.1)	40 (53.3)	
Dyslipidemia			
Yes	33 (57.9)	21 (28.0)	**0.001**
No	24 (42.1)	54 (72.0)	
Low back pain			
Yes	19 (33.3)	24 (32.0)	0.871
No	38 (66.7)	51 (68.0)	
Knee pain			
Yes	13 (22.8)	7 (9.3)	**0.033**
No	44 (77.2)	68 (90.7)	

Values are shown as *n* (%)
Bold values indicate a significant difference ($p < 0.05$)
HD: hemodialysis

Table 3. Odds ratios in satisfied and unsatisfied groups

	OR	95% CI	*p* value
Sex			
Men	0.39	0.18 - 0.84	**0.015**
Women	1.00		
Age (years)			
< 65	2.02	0.79 - 5.13	0.140
65 - 74	1.43	0.61 - 3.34	0.414
≥ 75	1.00		
Body mass index (kg/m^2)			
< 25	0.95	0.38 - 2.35	0.912
≥ 25	1.00		
Duration of HD (years)			
< 5	2.11	0.79 - 5.64	0.135
5 - 10	1.39	0.36 - 5.33	0.629
≥11	1.00		
Cause of HD			
Diabetic nephropathy	0.89	0.41 - 1.92	0.761
Others	1.00		

OR: odds ratio.
Odds ratios were adjusted for all other variables shown in the table.
95% CI: 95% confidence interval
Bold values indicate a significant difference ($p < 0.05$)
HD: hemodialysis

among male patients on CHD. Further studies are needed to accurately and effectively evaluate physical activity using a tri-accelerometer in patients on CHD.

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