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Brief Communication

Word Memory was Related to Walking Speed Change in a Pre-Frailty One-Year Follow-Up Survey

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SUMMARY

The aim of this study was to clarify the association between physical and cognitive functions in older adults who converted from a robust health state to a pre-frailty in a one-year follow-up survey. A total of 82 participants were enrolled and classified by the Fried frailty index. The physical and cognitive functions of the participants were evaluated. Complete data samples were available for 35 participants, including 11 who remained robust and 24 who converted to a pre-frailty during the follow-up. Multiple regression analysis was performed to examine the association between the change of the usual walking speed (UWS) (± m/s) during the one-year observation period and the cognitive functions converted to a pre-frailty after one-year. The results revealed a significant association between the change of the UWS and the score for word list memory (WM) ($p = 0.026$). Our results suggest that decline of WM with much slower UWS might be associated with conversion to a pre-frailty.

1. Introduction

Frailty is commonly recognized as a geriatric syndrome characterized by a decline in physical activities and cognition. In regard to the potential of rehabilitative intervention to tackle this issue, a previous study reported that early intervention could be effective to prevent conversion to frailty.[1] The Fried frailty phenotype (FP) is applied for the diagnosis of frailty,[2] but information on pre-frailty implying a decline in physical and cognitive functions is limited.[3] Clinically, a cognitive decline with physical frailty has been reported to be associated with the aggravation of geriatric symptoms in community dwelling elderly.[4] Our study was aimed at clarifying the association between physical and cognitive functions in older adults converted to a pre-frailty during a one-year follow-up survey.

2. Method

2.1. Participants and outcome

Our study was performed from 2018 to 2019. A total of 82 participants aged 65 years old or over were recruited from Akita prefecture, Japan. All the participants had the ability to walk independently, without personal assistance, and were living at home. The frailty status was evaluated by FP,[2] 0 for robust, 1–2 for prefrail, and 3–5 for frail, and the participants divided into a group that remained robust (n = 11) and a group that converted from a robust to a pre-frailty (n = 24) during the one-year follow-up period (Table 1).

The physical and cognitive functions were measured at the start of the study and one-year later. The physical functions measured consisted of the usual walking speed (UWS) (m/s) during a 5-m walking test and the grip strength (kg). Test for cognitive functions included word recognitions by memory (WM) test, the trail making test-part A (TMT-A) & part B (TMT-B) and the symbol digit substitution task (SDST), based on the National Center for Geriatrics and Gerontology functional assessment tool (NCGG-FAT).[5] WM involved immediate recognition and delayed recall of a 10 word target list. Higher scores of WM (0–20 score) and SDST (0 ≤ score), less times of TMT-A & B (0–300 sec) indicate better cognitive function. Statistical analyses were conducted using, the Wilcoxon signed rank test and the Mann-Whitney U test. The association between change of the UWS during the one-year study period (±; a dependent variable) and the cognitive functions at the one-year following-up period (independent variables; WM, TMT-A & TMT-B, SDST) were analyzed by multiple regression analysis. SPSS Version 27.0 for Windows (SPSS Inc., Chicago. IL, USA) used for the statistical analyses, and the level of significance was set at $p = 0.05$. This study was conducted with the approval of the ethics committee of the Faculty of Medicine at Akita University (No. 273).

3. Results

Complete data samples were available for 35 participants, including of 11 from the robust group (mean age, 74.1 years; % female, 61.2%) and 24 from the pre-frailty group (mean age, 75.2 years; % female, 60.7%). After one-year, a slower UWS was observed in the pre-frailty and higher score for WM were observed in both groups (Table 1). Multiple regression analysis identified a negative asso-

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Table 1
Comparison of the baseline and after one year in the participants.

	Robust (n = 11)				Pre-frailty (n = 24)				p value
	Baseline				Baseline				
	Mean (SD)				Mean (SD)				
Age (year)	74.1 (6.5)				75.2 (5.8)				0.346
Gender (% female)	61.2				60.7				0.928
FP (% yes)									
Weight loss	0				7.1				0.509
Weakness	12.4				10.7				0.800
Exhaustion	7.1				3.6				0.280
Slowness	3.6				10.7				0.819
Low activity	7.1				3.6				0.532
	Baseline	Post-test	p value	Δ1	Baseline	Post-test	p value	Δ2	Δ1 vs. Δ2
	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	Median (IQR)		Median (IQR)	p value
UWS (m/s)	1.19 (0.15)	1.14 (0.31)	0.494	-0.63 (0.26)	1.27 (0.24)	0.86 (0.23)	0.000**	-0.33 (0.48)	0.021†
GS (kg)	35.7 (18.5)	34.6 (18.6)	0.594	-0.3 (1.9)	24.9 (11.4)	26.0 (7.5)	0.741	0.1 (5.6)	1.000
SDST (score)	39.0 (12.0)	42.0 (16.0)	0.432	2.0 (4.0)	39.0 (19.0)	36.5 (13.0)	0.637	-0.5 (4.5)	0.142
WM (score)	11.7 (4.0)	12.7 (3.0)	0.029*	2.0 (4.0)	9.0 (5.0)	10.7 (4.0)	0.002**	2.3 (4.6)	0.409
TMT-A (sec)	22.0 (13.0)	21.0 (11.0)	0.547	-1.0 (3.0)	22.0 (8.0)	20.5 (13.0)	0.943	1.0 (7.0)	0.494
TMT-B (sec)	35.0 (31.0)	34.0 (39.0)	0.789	4.0 (19.0)	41.5 (35.0)	41.0 (19.0)	0.217	-0.5 (14.8)	0.238

The symbol of Δ means amount of change of the outcomes between the baseline and the one-year periods.
FP, Fried frailty phenotype; GS, grip strength; IQR, interquartile range; SD, standard deviation; SDST, Symbol Digit Substitution Task; TMT-A, Trail Making Test-part A; TMT-B, Trail Making Test-part B; UWS, usual walking speed; WM, word list memory.
* $p < 0.05$; ** $p < 0.01$; the Wilcoxon signed rank test, † $p < 0.05$; the Mann-Whitney test.

ciation between the change of the UWS and the score for WM at the one-year following-up period (coefficient, β = -0.454; 95% confidence interval [CI], -0.074, -0.005; p = 0.026) (Table 2).

4. Discussion

Our study showed that the change in the UWS during the one-year study period was negatively associated with WM other than TMT-A&B, SDST in the pre-frailty group. In regard to association between WM and UWS, many studies have reported the existence of associations between memory functions and decline in walking speed, and that the declines were associated with an increased risk of dementia in older adults.[6] For example, a study reported that poorer score in memory tests were associated with a higher risk of conversion of the health state to a pre-frailty over the following 4 years as compared to normal scores in tests of cognition.[7] Our study showed that while there was no cross-sectional association between the UWS and cognitive functions (data not shown), the change of the UWS during the one-year study period was related to WM. Although our study was only a preliminary one because of small sample sizes, high dropout rate, and data collection from a single institute, availability of the information on the relationship is limited until date, we believe that a decline in WM associated with slower UWS may be an early sign of pre-frailty. In conclusion, we suggest that WM might be negatively related to change of the UWS and could therefore be one of the predictors of conversion to pre-frailty.

Conflict of interest

The authors have no conflict of interest to declare.

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Table 2
Multiple regression analysis of UWS change values in pre-frailty.

	Coefficient (β)	t	p value	95% CI
Constant		0.451	0.656	-0.322, 0.501
WM	-0.454	-2.387	0.026	-0.074, -0.005

UWS, usual walking speed; WM at following-up, a score of word list memory at one-year following-up period; 95% CI, 95% confidence interval. Dependent variable, UWS change value for one-year; independent variables, cognitive domains at one-year later. Model, p = 0.026; $R^2 = 0.21$. Excluded independent values, TMT-A (r = -0.061, p = 0.782), TMT-B (r = -0.027, p = 0.903), SDST (r = 0.053, p = 0.810). r, correlation coefficient.

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