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Characteristics of ADL Ability on Partially Dependent Older Adults: Comparison among Different Ambulatory Activities Levels

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Abstract. The purpose of the present study was to clarify the characteristics of ADL ability among different ambulatory level groups. The subjects were 448 partially dependent older adults (PD; 126 male, 81.7 ± 8.22 year; 322 female, 82.5 ± 7.25 year) over 60 years of age, and they were divided into 3 groups based on ambulatory activity level; G1 could not walk without assistance; G2 could walk with a stick; G3 could walk without assistance. The PD were asked 17 ADL questionnaires representing seven ADL domains to evaluate the ADL ability. Total and domain ADL scores, and achievement rates for each item were calculated, and compared among different ambulatory activity groups. It is confirmed that ADL ability level in PD significantly relates to ambulatory level and becomes gradually higher as the ambulatory activity level advances. It is considered that in the G1, lower limb ability level is low, and the contribution of ability level regarding changing posture and manual activities to total ADL ability level is high. On the other hand, in the G3 the achievement levels in manual activities and high-difficulty ADLs using lower limbs reflects the differences in the ADL ability level among individuals. Gender differences for ADL ability are not found in any ADL domain, while age differences are found in only the G3. It is inferred that for the G1, the achievement levels of ADLs are largely influenced by disease morbidity and age contributes very little to the decline of ability level.
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Keywords: partially dependent older adults, ADL, ambulatory activities level, disability

Introduction

In previous studies, it has been reported that mobility disabilities were frequently found in not only hospitalized patients but also in community-dwelling persons (Winograd et al., 1994). A decrease in mobility causes a reduction in the range of activity in daily life and decreasing functional levels for various activities. In addition, it has been reported to bring about a decrease in the quality of life (Noro and Aro, 1997). It is, therefore, considered that independence in mobility would be indispensable for older adults to be independent in daily life, and that an assessment of mobility level would be important.

The functional level in partially dependent older adults (PD) is considered to be diverse and is governed by various disease morbidities. The scope of activity is also broad, ranging from bed-bound, to chair-bound, to house-bound. The range of activity is considered to be closely related to mobility and activity of daily living (ADL) ability levels (Tsuchiya et al., 1991). In addition, it has been reported that ADL disability would be a significant predictor for stroke mortality, and that limitations in ambulatory activity significantly increases the risk of heart disease mortality (Tsujii et al., 1994). It has been reported that the ambulatory activity level is associated with a decline of ADL ability, ruling one's sphere of activity (Mahoney et al., 1999). Furthermore, ambulatory activity level and the use of an assisting device have been reported to be more sensitive measures in predicting future ADL disability (Ostir et al., 1998; Mahoney et al., 1999).

These previous reports mean that ambulatory activity in PD is closely related to ADL ability level, and suggest that it is important to especially assess ambulatory activity level among mobility activities and to compare the characteristics of ADL ability among groups with different ambulatory activity levels.

Considering the circumstances mentioned above, the purpose of this study was to clarify the characteristics of ADL ability among different ambulatory activity level groups.

Methods

Subjects

The subjects of this study were 448 PD (126 male, mean age 81.7 SD ± 8.22; 322 female, mean age 82.5 SD ± 7.25) over 60 years of age. The PD lived in health facilities and homes for the aged, and belonged to rank A (needing partial assistance for indoor and outdoor activities) and rank B (needing partial assistance only for outdoor activities) according to the standard of independence level for dependent older adults approved by the Japan Ministry of Health and Welfare in 1991. The PD were divided into 3 groups (G1, G2, and G3) based on ambulatory activity level. G1 consisted of 120 PD (mean age 82.3 SD ± 7.20) who could not walk without assistance. G2 consisted of 140 PD (82.5 SD ± 6.48) who could walk with a stick. G3 consisted of 188 PD (80.9 SD ± 7.78) who could walk without assistance. No significant difference in mean age was found among the 3 groups and between the genders of each group.

Concerning disease morbidity of the PD, the percentages for the following diseases were high: cardiac disease, cerebrovascular disorders, articular impairments, and skeletal impairments. The disease morbidity tendency among the 3 groups was similar (Table 1).

Table 1 Disease morbidity status (number) of each group

	G1	G2	G3
Cardiac disease	31	27	38
Cerebrovascular disorders	76	67	76
Respiratory disease	11	7	17
Digestive organs diseases	15	10	29
Diabetes	12	10	18
Articular impairments	28	38	18
Skeletal impairments	21	33	22
Optic disease	10	12	13
Skin disease	0	1	4
Neuralgia	4	5	7

The plural answers.

ADL items

In this study, 17 ADL items were selected from the following seven ADL domains: changing and holding posture, dressing, using the toilet, walking, bathing, manual activity, and movement and carrying (Table 2). Each item was assessed on a dichotomous scale. The items selected were based on the major ADL indices, considering theoretical validity and characteristics of the population. Furthermore, the reliability and validity of these items were ensured in our previous study (Demura et al., 1999).

Survey

The survey was conducted at health facilities and homes for the aged, in Japan. The survey period at each institution was about four to six weeks. Therapists such as OT, PT, nurses, and social workers working at the subjects' institutions responded to the ADL index survey.

Statistical analyses

The following statistical analyses were executed for each group. Overall and domain ADL scores (the number

Table 2 ADL items selected in this study

ADL domain	No.	ADL item	Content of each ADL item
I	1	Turning over in bed	Can turn over in bed without assistance.
Changing and	2	Changing posture from lying to sitting	Can change posture from lying to sitting.
holding posture	3	Changing posture from sitting to standing	Can change posture from sitting to standing without hanging on to something.
	4	Holding standing posture	Can hold standing posture without assistance for about a minute*.
II	5	Putting on a shirt over the head	Can put on a shirt over the head within about 30 seconds*.
Dressing	6	Putting on slacks	Can put on slacks while standing.
	7	Putting on trousers(buttons, belt)	Can put on trousers including button, belt, and within about 1 to 2 minutes*.
III	8	Using the toilet (Western style)	Can use a Western-style toilet without assistance.
Going to toilet	9	Going to the toilet	Can go to and use a Western-style toilet without assistance.
IV	10	Washing the whole body	Can wash your whole body without assistance.
Bathing	11	Getting in the bathtub	Can straddle the bathtub and go inside without assistance.
V	12	Eating	Can eat something small such as a bean using chopsticks.
Manual activities	13	Writing	Can write by hand in normal size.
VI	14	Walking	Can walk without a self-help device.
Walking	15	Going up stairs	Can go up and down the stairs one step at a time without hanging on to a handrail.
VII Movement	16	Carrying object	Can carry relatively light things such as a piece of clothing, a garden plant, or a pan.
and carrying	17	Sphere of activity	Can go for a walk in the neighborhood.

The subject being tested responded "possible" or "impossible" to the above-stated questions.
*: The times using in criterion of assessment were determined based on the results of survey for occupational therapists.

of ADL items a subject could achieve), and achievement rates for each item were calculated. The frequencies of each overall score were calculated to examine the distribution of the overall score. Two-way (gender × age groups) analysis of variance (ANOVA) of overall score and each domain score was applied to examine gender and age differences in ADL ability. Ages were grouped into three age brackets: 60–79 years old, 80–89 years old and 90 years and older. If the main effects were significant, multiple comparisons were carried out, using Tukey's HSD test. In addition, if an interaction was significant, each simple main effect was examined, and then multiple comparisons were carried out. Pearson's product moment correlations were calculated between domain ADL scores and age or overall ADL score.

Results

ADL scores for each ambulatory activity level

The frequency distribution of overall score (high score was 17) is shown in Fig. 1. The distribution of overall score ranged from 0 to 5 in G1, 0 to 13 in G2, and 1 to 17 in G3. When calculating the ADL score (overall and domain scores) and achievement rates for each group (Tables 3 and 4), these values increased gradually from G1 to G3.

Gender and age differences for ADL ability

ANOVA for ADL domain scores in G3 (Table 5) revealed significant age differences in all domains. There were no significant interaction and gender differences in any domain. Significant correlations between domain scores and age (− 0.190 to − 0.373) were found in all domains excepting manual activity. In this study, since ADL ability levels in G1 and G2 were extremely low (ADL domain scores were nearly 0), it was not meaningful to analyze in the same way as G3. Thus, the two way ANOVA (gender × age) for ADL domain scores was not applied to these two groups. In the overall score for G3, there were significant age differences but no significant interaction and gender differences. In multiple comparisons, overall scores

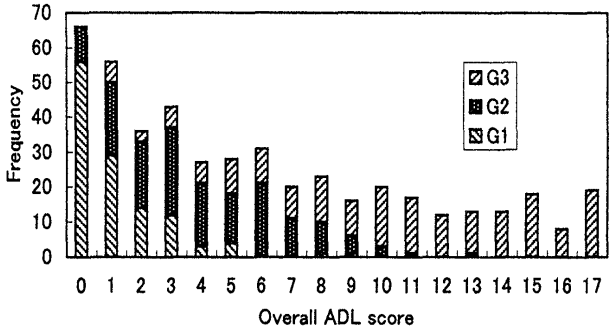

Fig. 1 Frequency distribution of overall ADL score of each group

for the 60-79 years old and 80–89 years old were significantly higher than those for the 90 years and older for both genders. In contrast, no significant gender and age differences were found in G1 and G2.

The relationships between ADL domain scores and overall score

The correlations between ADL domain scores and overall score for each group are shown in Table 6. Except for walking activity in G1 and G2, all domain scores are significantly correlated to overall score in all groups.

Discussion

Winograd et al. (1994) reported that one-fifth to one-third of older hospitalized patients are dependent, one-fifth to one-third of community-dwelling elders reported difficulty walking, and more than one-third of men and half of women over age 85 reported difficulty walking up 10 steps. In Japan, it is also reported that 80% of older hospitalized patients are dependent (Takeda et al., 1994). Sonn (1996) indicated that walking speed for both women and men and sight impairment in men had the greatest influence on dependence in ADL. These reports suggest the importance of mobility assessment in the functional assessment of older adults. In this study, the characteristics

Table 3 Overall and domain ADL scores of each group

Domain	G1		G2		G3	
	mean	SD	mean	SD	mean	SD
Changing and holding posture	0.32	0.658	1.12	1.045	3.00	1.106
Dressing	0.10	0.327	0.41	0.597	1.22	1.135
Going to toilet	0.16	0.408	1.04	0.680	1.65	0.664
Bathing	0.01	0.091	0.34	0.641	1.11	0.889
Manual activity	0.59	0.736	1.12	0.760	1.47	0.687
Walking	0.00	0.000	0.00	0.000	0.95	0.702
Movement and carrying	0.01	0.091	0.24	0.572	1.08	0.850
overall ADL score	1.18	1.628	4.28	2.720	10.48	4.464

G1: n=120; G2: n=140; G3: n=188. All domain scores except walking were G3>G2>G1($p<0.05$). ADL score of walking was G3>G2, G1($p<0.05$).

Table 4 Achievement rates of each ADL item

	ADL items	G1	G2	G3
1	Turning over in bed	18.3	45.7	85.1
2	Changing posture from lying to sitting	11.7	42.9	84.6
3	Changing posture from sitting to standing	0.0	0.7	48.9
4	Holding standing posture	1.7	22.9	81.4
5	Putting on a shirt over the head	8.3	30.7	55.9
6	Putting on slacks	0.0	2.1	31.4
7	Putting on trousers (buttons, belt)	1.7	8.6	34.6
8	Using the toilet (Western style)	1.7	30.7	79.3
9	Going to the toilet	14.2	72.9	85.6
10	Washing the whole body	0.0	11.4	46.3
11	Getting in the bathtub	0.8	22.9	64.9
12	Eating	32.5	65.7	86.7
13	Writing	26.7	46.4	60.1
14	Walking	0.0	0.0	72.9
15	Going up stairs	0.0	0.0	22.3
16	Carrying object	0.8	12.9	58.0
17	Sphere of activity	0.0	11.4	50.0

G1: n=120; G2: n=140; G3: n=188.

Table 5 Gender and age differences of ADL score in G3

	60 and 70s			80s			90s			2-way ANOVA			Multiple comparisons	Correlation	
	n	Mean	SD	n	Mean	SD	n	Mean	SD	Gender	Age	Inter-action			
Changing and holding posture	25	2.9	1.40	20	3.1	0.77	8	1.8	0.66	ns	**	ns	m: 60 and 70s, 80s>90s	−0.190	**
	56	3.2	1.14	67	3.1	0.94	12	2.6	1.19						
Dressing	25	1.6	1.17	20	0.9	0.89	8	0.5	1.00	ns	**	ns	m: 60 and 70s, >80s, 90s	−0.373	**
	56	1.6	1.21	67	1.1	1.00	12	0.6	1.12				f: 60 and 70s>80s, 90s		
Going to toilet	25	1.6	0.70	20	1.8	0.54	8	1.4	0.70	ns	*	ns	m: ns	−0.171	*
	56	1.8	0.58	67	1.7	0.68	12	1.3	0.83				f: ns		
Bathing	25	1.3	0.87	20	1.2	0.81	8	0.4	0.70	ns	**	ns	m: 60 and 70s, 80s>90s	−0.228	**
	56	1.2	0.90	67	1.1	0.86	12	0.8	0.92						
Manual activity	25	1.5	0.64	20	1.6	0.58	8	0.9	0.78	ns	**	ns	m: 60 and 70s, 80s>90s	−0.105	ns
	56	1.4	0.71	67	1.6	0.65	12	1.1	0.64						
Walking	25	0.9	0.74	20	0.8	0.75	8	0.4	0.48	ns	**	ns	f: 60 and 70s>80s, 90s	−0.321	**
	56	1.2	0.73	67	0.9	0.59	12	0.7	0.62						
Movement and carrying	25	1.3	0.79	20	0.8	0.87	8	0.8	0.83	ns	*	ns	f: 60 and 70s>80s, 90s	−0.311	**
	56	1.3	0.86	67	1.0	0.78	12	0.8	0.83						
Overall score in G1	12	0.8	1.46	17	0.9	1.63	7	1.1	0.83	ns	ns	ns			
	30	1.6	2.14	45	0.9	1.22	9	2.0	1.56						
Overall score in G2	16	3.6	2.72	19	3.9	2.70	2	2.5	2.00	ns	ns	ns			
	27	4.9	2.97	67	4.3	2.57	9	3.9	2.57						
Overall score in G3	25	11.0	5.05	20	10.2	3.60	8	6.0	4.00	ns	**	ns	m: 60 and 70s, 80s>90s		
	56	11.7	4.70	67	10.4	3.63	12	7.7	4.61				f: 60 and 70s, 80s>90s		

m: male; f: female; ns: not significant; **: $p<0.01$; *: $p<0.05$; correlation: the correlations between age and each domain score; upper section: male; lower section: female.

Table 6 The relationship between overall score and domain score

	I	II	III	IV	V	VI	VII
G1	0.747**	0.671**	0.659**	0.440**	0.779**		0.384**
G2	0.720**	0.458**	0.708**	0.638**	0.654**		0.557**
G3	0.754**	0.795**	0.647**	0.786**	0.608**	0.768**	0.755**

I to VII are shown in Table 3. The VI (walking) scores in G1 and G2 was 0.

of ADL ability were compared among 3 ambulatory activity groups. The overall ADL scores for the groups were G3=10.5, G2=4.1, and G1=1.2, which have an increasing tendency from G1 to G3. It is considered that the PD who could walk without assistance was particularly superior in ADL ability level compared to the others. Winograd et al. (1994) indicated the importance of mobility assessment, and developed the mobility examination (ME). They reported that as a result of examining the correlations between ME score and two ADL scores using a basic ADL index (Katz et al., 1970) and an instrumental ADL index (Lawton and Brody, 1969), significant relationships were found between mobility level and ADL ability. Since similar results regarding these relationships were also found in this study, it is inferred that the ambulatory activity level in PD would also closely relate to ADL ability level and become an important factor to gaining independence in daily life.

In examining the characteristics of each ADL domain ability for PD from the viewpoints of achievement difficulty, gender differences, and decreasing ability with age, in all ADL domains the relationships of functional levels among the 3 groups corresponded well to the overall score results. G3 was superior to the other 2 groups in all domains and G2 was superior to G1. The domain with the least ability difference among the 3 groups was manual activity. In G1 (achievement rates for 17 ADL items were from 0 to 32.5%), achievement rates regarding changing posture (turning over in bed: 18.3%; changing posture from sitting to standing: 11.7%) and manual activities (eating: 32.5%; writing: 26.7%) were relatively higher than those for other domain activities. In addition, in the correlations between domain scores and overall score, in G1 (0.384 to 0.779) only the correlations regarding manual activity and changing posture were greater than 0.7. In contrast, in the case of G3 (22.3% to 86.7%), achievement rates regarding activities using upper limbs such as putting on shirts over the head (55.9%), washing the whole body (46.3%), and writing (60.1%) were relatively lower than other activities. Also in G3, lower limb activity such as putting on slacks and trousers (31.4%, 34.6%), changing posture from sitting to standing (48.9%) and going up stairs (22.3%) were difficult to achieve. It is considered that the activities of holding a standing posture on one foot, standing up with a heavy burden at the knee, and moving up or down steps was more difficult than mobility on a flat surface (Kempen and Suurmeijer, 1990; Demura et al., 1999; Heinemann et al., 1993), and that the diversity of achievement level became more easily apparent in these activities. Considering these results, it is speculated that in G1 the activity levels of manual activity and changing posture largely contributed to the determination of the overall ADL level, while in G3 the achievement levels in the manual activities and high-difficulty ADLs using lower limb reflects the differences in ADL ability level among individuals.

In the case of G2 (achievement rates for 17 items were 0.6 to 69.0%) with some degree of ambulatory activity level, the ADL ability level in G2 was between G1 and G3. Because of the possibility that the elderly needing human or physical assistance for achievements in limb activity in G2 is higher than the other two groups, it is important to be more careful in assessing ADL ability. When assessing ADL ability in G2, it should be considered that the difficulty order in G2 among 17 ADL items based on achievement rates is similar to that of G3.

The PD who cannot walk and lives bed-bound or chair-bound, can achieve only some of the manual and upper limb activities and posture changes. In contrast, the PD who cannot walk without assistance and lives house-bound includes the elderly who are independent in mobility but not independent for some manual and upper limb activities because of disease morbidity. Furthermore, the PD who can walk with a stick needs human and physical assistance to achieve mobility and other activities. Thus, the differences in ambulatory activity levels in PD means not only a difference in ADL ability levels but also a difference in the characteristics of ADL.

As a result of examining the characteristics of ADL ability from the viewpoints of gender and age, no significant gender differences were found in any group. It has been reported that the gender differences in overall ADL ability level in PD were not found in basic ADLs like those used in this study, because in these basic activities it is difficult to be influenced by a gender factor by way of activity and in the achievement frequency of daily life (Demura et al., 1999). From the results in the present study, it is inferred that there are no gender differences in ADL ability in any ADL domain regardless of ambulatory activity level. In the decline of ADL ability level with age, significant differences were found in G3, while they were not found in G1 and G2. In general, it has been reported that ADL ability in older adults decreases with age. Our previous study also clarified that the ADL ability in PD decreases with age (Demura et al., 1999). When examining age differences in the present study, the decreasing trend of ADL ability level due to aging showed differences among the groups with different ambulatory activity levels. The decline of achievement level with aging was found remarkably in the PD who could walk without assistance. It may be that the PD with a lower ADL ability level has a disease, and that their ADL ability level is somewhat predetermined by disease morbidity and the increase in age does not have a large influence on the decline of the ability level. Furthermore, because in general upper limb and manual activities are the most basic ADLs directly relating to life-support and they have a lower difficulty compared to ADLs using lower limbs, it is easy to maintain an achievement level of these activities until they become older (Dunlop et al., 1997). The results corresponding to the above-mentioned report have also been reported regarding ADL ability in PD (Demura et al., 1999). This may be one of the reasons why no age

differences were found in the PD who could not walk without assistance and had a lower ability level.

In summary, it is confirmed that ADL ability level in PD relates significantly to ambulatory level and becomes gradually higher as the ambulatory activity level advances. Furthermore, regarding the ADL ability characteristics of each group, it is considered that in G1, ability level of ADL using lower limbs is low, and the contribution of the ability level of changing posture and manual activities to overall ADL ability level is high. On the other hand, in G3 the achievement levels in manual activities and high-difficulty ADLs using lower limbs reflects individual differences in ADL ability. Gender differences for ADL ability were not found in all ADL domains, while age differences were found only in G3. It is inferred that for G1, the achievement levels of ADLs and their decline are more largely influenced by disease morbidity than aging.

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