The Relationships of Motor Function, Education, Age and Cognitive Function to the Physical Activities of Daily Living

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The physical activities of daily living are a final outcome of many functions and dependent on many factors. This study was aimed at exploring the relationships of motor function, dementia, education, age, and cognitive function to the physical activities of daily living in 67 elderly people residing in an institution in Taegu, Korea. Their mean(±SD) age was 75.6 ± 8.1 and 24(35.8%) were men. Twenty-eight(41.8%) were classified as having definite cognitive impairment, 17(25.4%) as having questionable impairment, and 22(32.8%) as having no impairment by the Korean version of the mini-mental state examination. Of the aforementioned 5 variables, the Motoricity Index could account for 42% of the Barthel Activities of Daily Living variance. If the modified Blessed Dementia Rating Scale was included in the multiple regression, the accountable portion of the Activities variance increased by 4% only. Using the 2 variables, regression equation, $y=0.248 \times x1-0.359 \times x2-6.250$(y : Barthel Activities of Daily Living score, $x1$: Motoricity Index score, $x2$: modified Blessed Dementia Rating Scale score) could be produced. Conclusively, the physical activities of daily living of elderly people could be related mainly with motor function of the limbs and severity of dementia.

Key Words : *Activities of daily living, Dementia, Cognition, Motor function*

INTRODUCTION

The common goals of the assessment of the activities of daily living include establishing a base-line description, screening for risk factors or undetected problems, assisting in diagnosis, setting rehabilitation or therapeutic goals, and monitoring the patient's clinical course. Impairment of the activities of daily living is expressed in two ways, i.e., physical activities of daily living and instrumental activities of daily living. Both activities of daily living are affected by age(Hunt, 1979), physical disease(Report of the Royal College of Physicians, 1986), and cognitive impairments(Ferm, 1975 ; Pfeffer et al., 1982 ; Little et al., 1986). Depression is also associated with activity limitation and disability(Turner and Noh, 1988 ; Livingston et al., 1990). Physical activities of daily living constitute the skills of self-maintenance or those needed to care for one's body within a limited space, such as at home. They assess eating, dressing, grooming, toileting, bathing, transferring and mobility, and were found to be strongly related to short-and long-term survivals

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among elderly people in institutional or home cares (Donaldson et al., 1980; Donaldson and Jagger, 1983; Manton, 1988; Warren and Knight, 1982). Instrumental activities of daily living refers to the skills and behaviors needed to survive in the community and consist of money management, household chores, use of transportation, shopping, health main- tenance, communication and safety preparedness.

They are supposed to be influenced by many factors, i.e., demographic variables, motor function and cognitive function. However, some of them may not be etiologically related to the physical activities of daily living while others may be. In this paper, we attempted to explore the factors which have important effect on the physical activities of daily living in the elderly using an institutionalized group. This may help identify factors related to the physical activities of daily living in the aged people. It may also help easily identify individuals with impairment in the physical activities of living in clinical setting, institutional care, or community-based population. Early idenitification and intervention could prevent impairment of the physical activities of daily living.

MATERIALS AND METHODS

The subjects were 90 residents of an institution located in Taegu as of January 1. 1993. Their ages ranged from 60 to 96 years. The evaluations of the subjects were conducted between January and April, 1993. Cognitive functions and motor function of the limbs were assessed by one neurologist and two psychiatric residents while the physical activities of daily living and dementia severity were measured by their caregivers. Depressive symptoms, hearing and vision were also examined.

For the measurement of cognitive functions, the Korean version of the mini-mental state examina- tion(MMSEK) (Park and Kwon, 1990) was given. The raw score is corrected according to school education and ranges from 0 to 30. Therefore, the MMSEK score is the corrected score unless specifically indi- cated. A higher MMSEK score means better cognitive functions. The corrected MMSEK score is divided into three categories : no cognitive impairment(score>24), questionable cognitive impairment(score 21-24), and definite cognitive impairment(score<21) (Park et al., 1991).

The physical activities of daily living were measured using Barthel activities of daily living(BADL) (Mahoney

and Barthel, 1965). This covers the daily activities of feeding, bathing, grooming, bowels, bladder, toilet, chair/bed transfer, dressing, mobility, and stairs. The maximum score is 20. In modification for use with Korean elderly people, 3 points on chair/bed transfer was reduced to 2 points and the maximum score is 19 in this study(Park et al., 1995). A higher score means better activities. Care-givers completed the scale based on the activities of the elderly during one week prior to the test day.

Motor function of the limbs was evaluated with the Motoricity Index(MI) (Demeurisse et al., 1980). This was initially developed for assessment of progress in motor recovery in vascular hemiplegia. Weighted values of motor functions of the shoulder, elbow, wrist and hand, hip, knee and foot on both sides were summed and averaged. Zero means total immobility of the 4 limbs and 100 means full strength of motor functions.

Severity of dementia on the Blessed Dementia Rating Scale was shown to be significantly correlated with the neuropathological changes of the cerebral gray matter in demented patients(Blessed et al., 1968). This assesses everyday activities, habits, and personality, interests and drive. The modified form of the Blessed Dementia Rating Scale(mBDRS) which lacks changes in personality, interest and drive, is frequently used and was employed for measurement of dementia severity in the present study. A subject with profound dementia can score 17 while a subject with no dementia scores 0. Its test-retest and inter- tester reliabilities were very high(Park et al., 1995).

Depression was assessed using a self-rating de- pression scale. Its items were derived from depress- ive symptoms listed in mood disorder of the Diagnos- tic and Statistical Manual of Mental Disorders, 3rd edition-Revised(American Psychiatric Association, 1987) and were 20 in number. The participants were asked to read the items and check either yes(have) or no(have not) response for all items during the past one week. It covers affective, vegetative and cognitive spheres of depression. The scale items had been made by one of the authors(JP) and are very under- standable even for the elderly with poor educational background.

Vision and hearing were also checked at the time of examination and grouped as total loss, partial loss and no impairment. Partial loss means hearing or visual impairment to interfere with daily lives. Hearing aid was considered as partial loss. But wearing

Table 1. Correlation coefficients between variables*

	Age	Education	MMSEK	mBDRS	BADL	MI
Age	–					
Education	-.310†	–				
MMSEK	-.336†	.420‡	–			
mBDRS	-.028	-.164	-.503‡	–		
BADL	.044	.009	.226	-.355†	–	
MI	-.087	.054	-.234	-.251	.645‡	–

*1-tailed significance : †p<0.01, ‡p<0.001.
MMSEK indicates corrected score on Korean version of mini-mental state examination ; mBDRS, modified Blessed Dementia Rating Scale ; BADL, Barthel Activities of Daily Living ; MI, Motoricity Index.

glasses was considered normal if activities were normally maintained with glasses.

Analysis of data

X^2-test was used for comparison between groups of non-parametric data, two-tailed t-test for comparison of parametric data, eg. age, MMSEK score, mBDRS score, BADL score, and education. Pearson's correlation coefficients were computed for correlation between variables and their statistical significances were based on the 1-tailed significance. BADL score was considered as the dependent variable while age, education, MMSEK score, mBDRS score, and MI were considered as independent variables when the effects of these variables on BADL were analyzed. Stepwise multiple regression analysis was used. Vision, hearing and depression did not enter the analysis : measurement of vision and hearing was too inexact and the depression scale was not standardized at the time of the analysis.

RESULTS

Twenty-three(25.6%) of 90 elderly residents could not complete all the evaluations because of hearing difficulty in 8, speech disturbance in 5, refusal in 3, death in 3, and others in 4. Analyses revealed no differences between the participants and non-participants with respect to sex, age, mBDRS, BADL, or education, but the mean(±SD) MMSEK score was significantly lower in the 7 MMSEK-testable nonparticipants(14.1±9.1) than in the participants(21.2 ±6.0) (t=2.79, p=0.007).

The data of the remaining 67 were subjected to analysis. Twenty-four(35.8%) were men and 43(64.2%) were women. Their ages ranged from 60 to 96 years, with a mean(±SD) of 75.6 ±8.1.

Thirty-four(50.7%) had experienced no schooling, 21(31.3%) had been educated in grade school, 10(14.9%) in junior or senior school, and 2(3.0%) in college. The MMSEK score classified 28(41.8%) as having definite cognitive impairment, 17(25.4%) as having questionable cognitive impairment, and 22(32.8%) as having no cognitive impairment.

Correlations between individual variables are shown in Table 1. The educational level and MMSEK score were negatively correlated to age. The MMSEK score was negatively correlated with the mBDRS score, and the mBDRS score was positively correlated with the BADL score. Only the mBDRS and MI of the 5 variables were significantly correlated with the BADL score. The BADL score was −0.252(p=0.020) correlated with the score on the mBDRS everyday activities and was −0.428(p<0.001) correlated with the score on changes in the BDRS habits.

Stepwise multiple regression analysis showed that the coefficient of determination, R^2 was 0.42 when the MI was included in multiple regression analysis(ANOVA : df=1, sum of square=784.07, F=46.302, p< 0.001). When both MI and mBDRS were included in the regression analysis, R^2 increased to 0.46(ANOVA : df=2, sum of square=859.53, F=26.828, p<0.001). Using the two variables, a regression equation could be produced : $y=0.248 \times x_1 - 0.359 \times x_2 - 6.250$ (y : BADL score, x_1 : MI score, x_2 : mBDRS score). Age, education and the MMSEK score were not significantly important variables in explaining BADL.

DISCUSSION

Summarizing the results of the present study, age, education and the MMSEK score could not account for BADL variance. A large portion(42%) of the BADL variance is accounted for by the MI. If the mBDRS

was included in the regression analysis, the accountable portion of the BADL variance increased by 4% only, although the correlation between mBDRS and BADL scores was −0.335. This may be due to multicolinearity between the MI and mBDRS.

It was expected that the correlation of the mBDRS score with the BADL score would not be so high even if statistically significant. All BADL items address physical activities of daily living while the mBDRS consists of 2 components : items related to physical activities of daily living(eating, dressing and continence) and items related to cognitive functions(household tasks, money handling, memory, orientation in place, and interpreting surroundings). This is further supported by the finding that the correlation of the BADL score with performance of mBDRS everyday activities was lower than its correlation with changes in mBDRS habits. Motor impairment is supposed to be highly reflected in such physical activities of daily living as eating, dressing and continence.

The current study shows that age has by itself little effect on the BADL. If age has some effect on the physical activities of daily living, it may result from motor impairment due to degenerative changes in extremities and/or cerebrovascular accidents which are closely related to increasing age. It is well known that education has a big influence on the cognitive performances of the elderly, but has little effect on the physical activities of daily living. Education may have some effect on the instrumental activities of daily living.

Clinical manifestations of dementia could be divided into cognitive dysfunctions, mental symptoms and impairment in activities of daily living. Little is known about relationships between the 3 spheres although they are likely to be correlated with each other in terminal stage. Using the mBDRS and Haycox Dementia Behavior Scale(Haycox, 1984), it was found that cognitive and behavioral impairments may progress independently in the mixed dementia of Alzheimer disease and vascular dementia(Kurita et al., 1993). The Haycox Dementia Behavior Scale assesses language-conversation, social interaction, attention, spatial orientation, motor performance, bowel and bladder behavior, eating/nutrition, and dressing/grooming. Dementing illnesses cause a great deal of functional impairment, first at the highest level and then progressively impairing lower levels(Winograd, 1984 ; Warren et al., 1989). Accordingly, the physical activities of daily living are not significantly related to MMSEK score which may be correlated to the instrumental activities of daily living. Rozzini et al.(1993) found that cognitive impairment and depression could explain 28% of the BADL variance. The development of cognitive impairment is often due to progressive dementia, leading first to impairment of the instrumental activities of daily living and later to impairment of the BADL. Therefore, the MMSEK may be poor in predicting the BADL while good in predicting the instrumental activities of daily living.

The assessment of physical function and disability could be a mainstay of clinical evaluation for elderly people. However, it is very frequently neglected both in the clinical setting and institutions. Of the instrumental and physical activities of daily living, the physical ones are more fundamental and essential for survival and its assessment should be minimum requirement in all aged people under medical or institutional care. As seen in this study, motor function of the extremities and severity of dementia could give an assumption about the physical activities of daily living, while other factors could not. For this reason, the motor function and dementia should be evaluated in all aged people under medical concern. And any individual with impairment of motor function should be a strong candidate for physical rehabilitation in order to prevent deterioration of the physical activities of daily living and to reduce burdens on care-givers.

Depression common in the elderly group may result in impairment in the physical activities of daily living even though not analyzed in this study. Relationship between depression and the physical activities of daily living awaits for further study using a depression scale with high reliability and validity in elderly people. The subjects of this study were heterogenous regarding the severity of cognitive function. The more homogenous group, either demented or cognitively intact, may show different findings.

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