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Original Article

Does Gait Speed Replace Comprehensive Geriatric Assessment in the Elderly?☆

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SUMMARY

Background: Ageing is associated with generalized slowing of movement. Gait speed is an indicator of physical performance. The present study aimed to determine whether the gait speed could replace the comprehensive geriatric assessment (CGA) to assess the status of the elderly.
Methods: 531 participants aged 60 or more years were recruited from inpatients and community population in this study. The CGA was performed, including sociodemographic information, neuropsychological assessment, nutritional status, social support and physical health assessment. Moreover, timed gait speed (m/s) was assessed over 20 m at a usual pace. Receiver operating characteristic (ROC) curve of gait speed was constructed to determine the optimal threshold of gait speed for CGA components.
Results: 285 (53.7%) participants had a low gait speed (gait speed ≤0.8 m/s). Gait speed was associated with age, some chronic diseases, disability, nutritional status, part of social support, multi-drug used, depression, mild cognitive impairment, length of hospital stay. ROC curve showed that the optimal threshold of gait speed between MCI and cognitive healthy individuals was 0.73 m/s (sensitivity: 67.6%, specificity: 68.3%).
Conclusion: Gait speed only reflects part of situations of the elderly. Thus, our present results do not support that gait speed may replace CGA to assess the status of the elderly.

1. Introduction

The main problems of the development of sociodemographic are the accelerated ageing population. With the progress of ageing, a variety of symptoms that may occur, such as slowly movement, poor physical condition, disability, falls, hospitalization[1–5]. Comprehensive geriatric assessment (CGA) is a multidimensional interdisciplinary diagnostic tool, which can determine an older person's medical, psychological and functional capability[6]. CGA is consists of a number of validated instruments that can be most effectively used to evaluate impact and needs in a series of domains, including functional status, cognition, comorbidities, polypharmacy, psychosocial function, social support and nutritional status[7]. CGA is a common way to determine the health and function status for elderly in geriatric experience, as it is regarded as one cornerstone of modern geriatric medicine[8]. However, the main disadvantage of CGA is time requiring, which is a burden of the elderly. Therefore, abbreviated, safe and easy to perform tools suitable for seniors assessments are extremely appealing[8,9].

Ageing is associated with generalized slowing of movement[10,11]. The ability to walk underlies many basic and community functions necessary for independence[12]. Walking requires multiple systems and organs support, such as central nervous system, peripheral nerves, bones and joints, muscles, heart and lungs, and blood. The capacity of walking can reflect the functions of organ systems[13]. 6-min walk test has been used as an important marker in cardiopulmonary disease to evaluate the level of exercise capacity[14]. Gait speed can reflect the function status of executive cognitive function in patients with cognitive impairment[15]. Therefore, the ability to

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move reflects the basic physical condition of the elderly and gait speed might be used as an indicator of basic organ functions. Recently, gait speed has been described as the sixth vital sign after body temperature, weight, blood pressure or respiratory rate[16]. Meanwhile, the measure of usual gait speed is easy, quick and inexpensive, not limited by time and space, and evaluation of gait speed at the time of hospital admission may provide useful information for the physician. Thus, we assume that whether the gait speed could replace the CGA to assess the basic situation of elderly, it would greatly reduce the burden of clinicians and the elderly.

2. Methods

2.1. Participants

Between 2011 and 2012, participants were recruited from Department of Geriatrics, The First Affiliated Hospital of Chongqing Medical University, and were volunteered from clinic of community service center, Jiangbei District, Chongqing. Inclusion criteria: 1) who were 60 years and older; 2) who had no history of neuropsychiatric disorders; 3) who could complete the gait speed test; 4) who agreed to participate in this study. Exclusion criteria: 1) who were present in the acute state of diseases or stress; 2) who were diagnosed as dementia; 3) who were unable to complete the gait speed test; 4) who refused to participate in this study. This study was approved by the Ethical Committee of The First Affiliated Hospital of Chongqing Medical University on human research. Informed consent was obtained from all participants or their family members.

2.2. Gait speed

20-m timed gait speed test was widely used to assess gait speed in older adults and in majority of epidemiological studies[17–19]. Therefore, a 20 m flat, unobstructed ground was used as a place to test gait speed in the present study. Participants were asked to walk at a self-selected pace and a stopwatch was used to record the time.

Gait speed is an importance marker of identifying dismobility in older patients[20]. It has been reported that people with gait speeds of about 0.8 m/s had the median life expectancy in elderly[21]. Moreover, gait speed 0.8 m/s are set as the cutoff value of many tests arranged from 4–6 m[21–22]. In addition, the fast 4-m test and 20-m test for gait speed were highly correlated[23]. Therefore, 0.8 m/s was chosen as the cutoff value in the present study. Participants were divided into two groups in our study based on 0.8 m/s, including low gait speed (gait speed $\leq$0.8 m/s) and normal gait speed (gait speed >0.8 m/s).

2.3. Comprehensive geriatric assessment

The multidimensional comprehensive geriatric assessment (CGA) was performed face to face by two professional geriatricians in a quiet room. Our department had a fixed manual for CGA operation; all geriatricians had to be trained by a senior geriatrician before participating in this study. Then, the senior geriatrician and a young geriatrician performed CGA together to ensure the consistency. The investigation included sociodemographic information (age, gender, education, work type), neuropsychological assessment (cognitive function, depression), nutritional status, social support (marriage status, household income, daily exercise, social activities and subjective sense of happiness) and physical health assessment (disability, chronic non-communicable diseases, medications, length of hospital stay). For more detailed information, see Supplementary Material 1.

2.4. Statistics

Means ± standard deviation (SD) were reported for continuous variables and percentages for categorical variables. Normality of all continuous data was analyzed using the Kolmogorov–Smirnov test. The independent t-test was used for normally distributed continuous variables and Mann–Whitney U test was used for non-normally distributed continuous variables. The chi-square test was used for comparison of categorical variables. Receiver operating characteristic (ROC) curve of gait speed was constructed to determine the optimal threshold of gait speed for components of CGA. All statistical analyses were performed with the use of SPSS-19.0. All statistical tests were 2-tailed and P-value was judged significant if it was less than 0.05. When AUC of the ROC curve less than 0.700, the cutoff value of the gait speed was inaccurate.

3. Results

285 (53.7%) participants had a low gait speed. The age of participants was older in low gait speed group than in normal gait speed group ($P < 0.001$). The median length of hospital stay in the past year was 20 days for the low gait speed group versus 15 days for high gait speed group ($P = 0.003$). The inpatients have a lower gait speed than the community participants. There was no significant difference in sex, work type, and education. Demographic characteristics of 531 participants were presented in Table 1.

In addition, to understand the cutoff value of gait speed for CGA components, we performed ROC curve analysis. We found the AUC of ROC curve was less than 0.700 in most of CGA components, indicating that the ROC curve was not suit for those components (see Supplementary Material 2), except for MCI (see following, Section 3.5).

3.1. ADL and gait speed

The ADL score was higher in low gait speed group than in normal gait speed group ($P < 0.001$). The number of disability was greater in low gait speed group than in normal gait speed group ($P < 0.001$). The median number of disability was one for low gait speed group versus zero for normal gait speed group ($P < 0.001$).

3.2. Chronic diseases and gait speed

The median number of chronic diseases was two for low gait speed group versus one for normal gait speed group ($P < 0.001$) indicating that numbers of disease contribute to the decline of gait speed. The prevalence of five diseases was higher in low gait speed group than in normal gait speed group, including: hypertension, coronary heart disease, COPD, gastrointestinal disease, cerebrovascular disease. There was no difference in incidence of lower extremity joints disease, liver disease, kidney disease, diabetes, cataract and tumor between two gait speed groups (Supplementary Table 1).

3.3. Polypharmacy and gait speed

The types of drugs used in participants with chronic diseases were greater in the low gait speed group than in normal gait speed group ($P = 0.005$). The incidence of polypharmacy is higher in low gait speed group than in normal gait speed group ($P < 0.001$).

3.4. Social support and gait speed

Participants with normal gait speed had a relatively higher marriage rate, longer daily exercise, greater participation in social

Table 1
Demographic characteristics of the participants with different gait speed.

Characteristics	All (n = 531)	Gait speed ≤0.8 m/s (n = 285)	Gait speed >0.8 m/s (n = 246)	P-value
Age, mean ± SD (years)	72.3 ± 7.7	74.9 ± 7.6	69.2 ± 6.7	0.000**
Male	232 (43.7)	114 (21.5)	118 (22.2)	0.065
Participants source, n (%)				0.000**
Hospital	236 (44.4)	182 (34.3)	54 (10.1)	
Community	295 (55.6)	103 (19.4)	192 (36.2)	
Married	400 (75.3)	201 (37.9)	199 (37.4)	0.006*
Mental laborer	298 (56.1)	164 (30.9)	134 (25.2)	0.477
Education, n (%)				
≤12 years	396 (74.6)	209 (39.4)	187 (35.2)	0.479
>12 years	135 (25.4)	76 (14.3)	59 (11.1)	
Existing chronic diseases, n (%)	431 (81.2)	246 (46.3)	185 (34.8)	0.001*
Number of chronic diseases	2 (1, 3)	2 (1, 3)	1 (0.75, 2)	0.000*
Number of drug used	4.9 ± 5.0	5.5 ± 5.9	4.2 ± 3.3	0.005*
Polypharmacy	100 (18.8)	72 (13.6)	28 (5.3)	0.000**
MNA-SF score	12.7 ± 1.7	12.5 ± 1.9	13.0 ± 1.3	0.000**
MNA-SF ≤11	98 (18.5)	64 (12.1)	34 (6.4)	0.011*
BMI, mean ± SD, (kg/m^2)	24.0 ± 3.5	23.9 ± 3.8	24.0 ± 3.2	0.589
Daily physical exercise				0.003*
≥1 h	339 (63.9)	165 (31.1)	174 (32.8)	
>0 h	88 (16.6)	50 (9.4)	38 (7.2)	
=0 h	104 (19.6)	70 (13.2)	34 (6.4)	
Social activities				0.000**
Often	28 (5.3)	7 (1.3)	21 (4.0)	
Sometimes	95 (17.9)	35 (6.6)	60 (11.3)	
None	408 (76.8)	243 (45.8)	165 (31.1)	
Happiness (subjective)				0.200
Very satisfied	51 (9.6)	26 (4.9)	25 (4.7)	
Satisfied	317 (59.7)	162 (30.5)	155 (29.2)	
Common	163 (30.7)	97 (18.3)	66 (12.4)	
Incomes (RMB/month)	2856.5 ± 1838.6	2982.1 ± 1931.8	2711.1 ± 1716.8	0.088
ADL score, mean ± SD	15.2 ± 2.8	16.0 ± 3.5	14.2 ± 0.8	0.000**
Number of disability	0 (0, 1)	1 (0, 2)	0 (0, 0)	0.000**
MMSE score, mean ± SD	27.4 ± 3.8	26.3 ± 4.6	28.7 ± 1.8	0.000**
MCI, n (%)	120 (22.6)	95 (17.9)	25 (4.7)	0.000**
Depression, n (%)	121 (23.0)	91 (17.3)	30 (5.7)	0.000**
Length of hospital stay (last year)	18 (10, 32)	20 (12, 40)	15 (10, 20)	0.003*

ADL: Activities of Daily Living, MNA-SF: Mini Nutritional Assessment Short Form, MMSE: Mini Mental State Examination, MCI: Mild Cognitive Impairment.
*P < 0.05; **P < 0.001.

activities. There was no significant difference in household incomes and subjective sense of happiness between two gait speed groups (Table 1).

3.5. Nutritional status and gait speed

There was no significant difference in BMI between two gait speed groups. The participants with normal gait speed had a relatively higher Mini Nutritional Assessment Short Form (MNA-SF) score compared with the participants with low gait speed (P < 0.001). The incidence of poor nutrition in low gait speed group was higher than in normal gait speed group (P = 0.011, Table 1).

3.6. MCI and gait speed

The prevalence of MCI was higher in the low gait speed group than in normal gait speed group (P < 0.001). The gait speed of MCI participants was significant lower than cognitively healthy individuals (P < 0.001). The cutoff value of the gait speed for MCI in all participants was 0.73 m/s (AUC: 0.716; sensitivity: 67.6%, specificity: 68.3%). The cutoff value of the gait speed for MCI was 0.98 m/s in community participants (AUC: 0.632; sensitivity: 51.0%, specificity: 75.0%) and 0.73 m/s in hospital patients (AUC: 0.618; sensitivity: 37.2%, specificity: 83.0%), respectively (Figure 1), indicating that 0.73 m/s cutoff might be only used in hospital.

3.7. Depression and gait speed

The prevalence of depression was higher in the low gait speed group than in normal gait speed group (P < 0.001). The gait speed of depression participants was significant lower than the healthy individuals (P < 0.001).

4. Discussion

Our present study shows that 53.7% participants had a low gait speed. Factors associated with gait speed include age, participants' source, disability, existing of chronic disease, nutritional status, parts of social support, multi-drug used, length of hospital stay, depression and cognitive impairment.

Chronic diseases are generally associated with gait speed decline. In our study, hypertension, cardiovascular disease, COPD, chronic gastrointestinal disease and cerebrovascular disease are associated with low gait speed. The results in present study are consistent with the previous studies[24–27]. Additionally, we observe that some chronic diseases have no significance correlation with gait speed, including lower extremity joints disease, liver disease, kidney disease, diabetes, cataract and tumor. Therefore, these results suggest that gait speed can probably reflect the heart, lung, brain, and gastrointestinal diseases.

We observe that the low gait speed participants have a relatively poorer nutritional status compared to normal gait speed participants. The poor nutrition status often has a tight association with

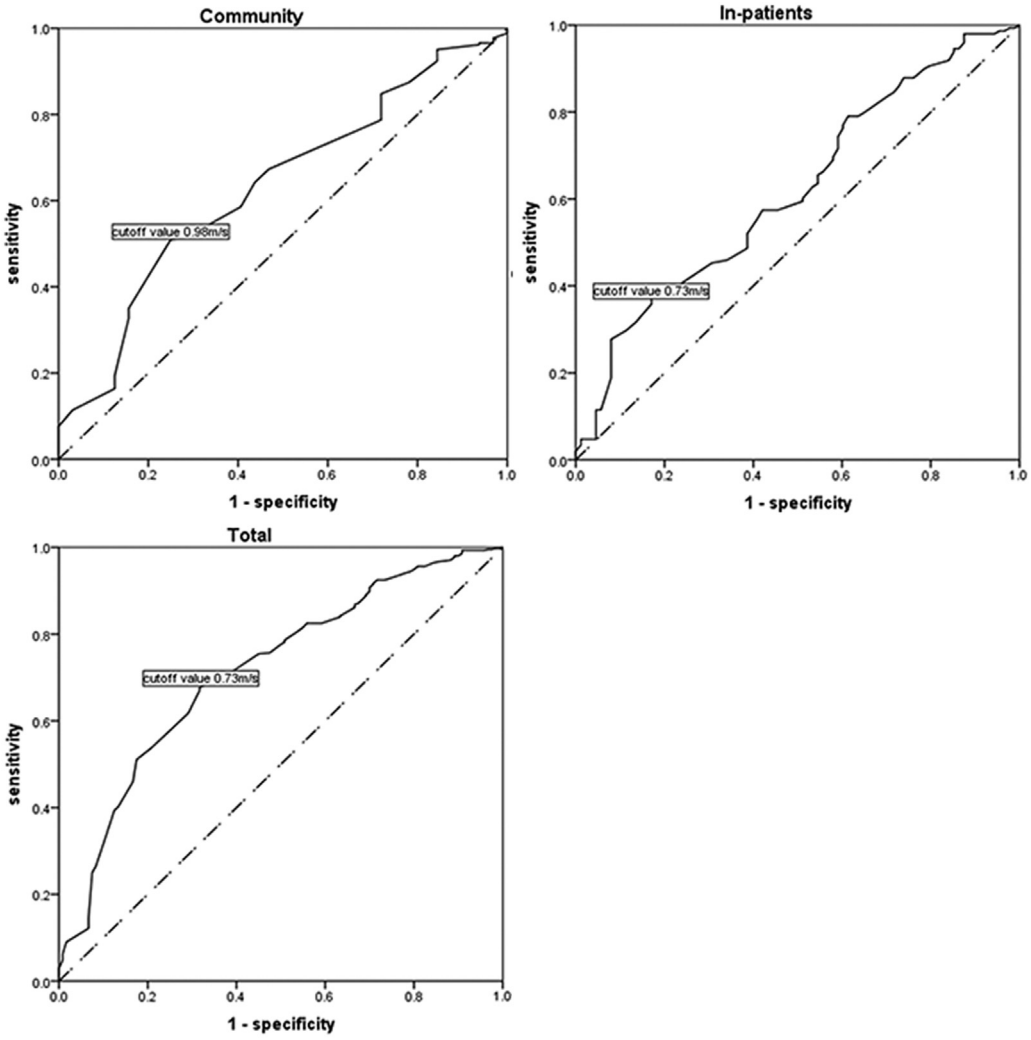

Figure 1. The probable cutoff value of gait speed for MCI using receiver operating characteristic curve.

frailty; the frailty people often have a slow gait speed[28]. Therefore, this phenomenon indicates that the gait speed may be used as a marker of the nutritional status.

Social support is associated with health and has a variety of sources, including: spouse support, friend support and financial support[29]. We find that participants with normal gait speed have a relatively higher marriage rate, longer daily exercise, greater participation in social activities. The spouse support, the social activities promote the people maintain a good mood and physical health, which is good for maintain the gait speed. However, there is no significant difference in household incomes and subjective sense of happiness, which indicates that the gait speed reflects some aspects of social support.

The present results show that slow gait speed is associated with cognitive decline and MCI, which are in agreement with previous studies[30–31]. Cognitive impairment is often associated with the atrophy of brain regions, including temporal, parietal, and frontal regions[32]. Moreover, smaller frontal regions are associated with slow gait speed[33]. Therefore, it is understood that declined gait speed and cognitive impairment have the correlation. Declined gait speed might be a screening biomarker of early cognitive dysfunction. In addition, our results indicate that the participants with gait speed of blow 0.73 m/s have a high risk of MCI based on inpatients, suggesting that cognition should be concerned when patients has lower gait speed with less than 0.73 m/s. We also find that the gait speed of depression participants is significant lower than the healthy individuals, which are in agreement with previous studies[34]. Therefore, we suggest that the declined gait speed might be a marker of early cognition impairment and depression.

Gait speed has been reported to be a clinically relevant indicator of functional status and is associated with length of hospital stay and home discharge[2]. We observe that low gait speed participants have a longer length of hospital stay compared with normal gait speed participants. Thus, patients with poor physical status need a longer length of hospital stay. Therefore, the measurement of gait speed might be a guide for clinicians to determine the length of hospital stay of inpatients. In addition, slow gait speed and low physical activity/exercise can be a predictor of disability[35]. In present study, both the ADL score and the number of disability are significant higher in low gait speed than in normal gait speed group. Thus, the gait speed test might be a useful screening indicator for disability and might simplify the measurement of physical functions.

We observe that the inpatients have a lower gait speed than the community participants. There are some explanations may explain the phenomenon. Firstly, the mean ages of inpatients are older than those of the community participants in our study. Age has association with gait speed decline[10]. Secondly, the inpatients have a

greater disability of daily life than community participants. It has been reported that disability is associated with the gait speed[1]. Thirdly, the inpatients have a greater number of chronic diseases than community participants, causing heavier extent of the diseases in inpatients. Previous studies show that the severity of the diseases associated with the gait speed decline[27].

Some limitations of the present study have to be acknowledged here. Firstly, this is a cross-sectional study with a relatively small number of samples, the data may only partly represent the status of gait speed in our region; therefore, investigations with large sample size in various populations across the regions should be performed. Secondly, we only measured the gait speed, but not other gait domains (stride length, turning, rhythm) due to the limitation of assessment time and patients' compliance. Therefore, further study is needed to establish a longitudinal study with a comprehensive gait speed test (different pace and gait domains).

In summary, gait speed might reflect some items of CGA, including some chronic diseases (heart, brain, lung, and gastrointestinal disorders), cognition, depression, function status, polypharmacy, length of hospital stay, part of social support. Thus, our present results do not support that gait speed may replace CGA to assess the status of the elderly completely.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ijge.2016.03.010.

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