Caspian Journal of Neurological Sciences
"Caspian J Neurol Sci"
Journal Homepage: http://cjns.gums.ac.ir

Research Paper: The Consistency and Construct Validity of Wolf Motor Function Test With Functional Variables and SF-36 Questionnaire in Iranian Stroke Patients

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Citation: Ezzati K, Salavati M, Abdollahi I, Shakeri H, Esmaili K. The Consistency and Construct Validity of Wolf Motor Function Test With Functional Variables and SF-36 Questionnaire in Iranian Stroke Patients. Caspian J Neurol Sci. 2018; 4(2):49-56.

Running Title: Validity of Wolf Motor Function Test in Stroke

Funding: See Page 62

Bullet Points:

- WMFT has acceptable construct validity with functional variables.
- WMFT has acceptable construct validity with overall score of the SF-36 questionnaire.

Article info:
Received: 28 Jun 2017
First Revision: 10 Jul 2017
Accepted: 05 Dec 2017
Published: 01 Apr 2018

ABSTRACT

Background: One of the most important indicators for assessing the validity of a scale is the determination of the construct validity of that scale. Since no standard gold test exists to measure the upper limb function in patients with stroke, the study of the construct validity of the Wolf Motor Function Test (WMFT) is of particular importance.

Objectives: To evaluate the construct validity of the scores of the Persian version of the WMFT with functional variables, as well as to verify its convergence validity with the physical component summary of the SF-36 Health Survey, and its discriminant validity with the mental component summary of SF-36 Health Survey.

Materials & Methods: The tests were conducted on 56 patients with stroke, and the scores were calculated. By using this data, the construct validity of the Wolf scale and the convergence and discriminant validity of the scores derived from the Persian version of WMFT, and the physical and mental component summary of the SF-36 Health Survey were obtained.

Results: There was no significant correlation between the age and duration of the stroke in patients, and the total functional score and the median time of performing the tasks of the Persian version of WMFT ($P>0.05$). No significant difference was seen between the sexes in terms of the total score of performing tasks, but the median time of performing the tasks was significantly different between men and women ($P=0.04$). There was a moderate statistical correlation between the scores of the Persian version of WMFT and the physical component summary ($r=0.60$, $P<0.001$ and $r^2=0.74$), and the mental component summary of SF-36 Health Survey ($r=0.60$, $P<0.001$ and $r^2=0.82$).

Conclusion: The Persian version of WMFT has acceptable construct validity with functional variables and the overall score of the SF-36 questionnaire.

Keywords: Stroke, Validity, Quality of life, Function

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Caspian Journal of Neurological Sciences

Introduction

People use their upper limbs to perform various functions and movements in their daily lives. The functional capacity of the upper limbs depends to a large extent on their ability to move in space, via the coordinated movements of the shoulders, elbows, forearms and wrists. Upper limb functional disorder is one of the most common long-term effects of Central Nervous System (CNS) damage, and one of the most important causes of disability and dependence in stroke. Although most stroke patients eventually regain the strength and control of their legs, they usually do not regain function of their upper limbs [1].

CNS damages often result in motor disorders that are characterized by lack of movement in the trunk and affected organs, abnormal and indistinctive motor patterns, or compensatory and synergistic movements. Patients suffering from CNS damage may also show changes in the quality of voluntary motor responses that affect the speed of movement, and the efficiency and symmetry of muscular activity [2]. Since the major concern of stroke patients is to regain the use of their hands, physical therapists need to have a thorough understanding of the problems that occur following upper limb dysfunction [3]. An accurate assessment of motor function is crucial to record the outcomes of the rehabilitation program and determine the appropriate treatment for the patient, compare the different treatments received by the patient, provide a solution for the patient's problem, and determine the needs of medical personnel [1-4].

Since there are no standard criteria for traits like pain, function, and the quality of life, it is important to assess construct validity of a scale measuring these traits [5]. In order to evaluate the construct validity, the theories regarding the traits or related variables are first considered, and then the relevance of the scale/tool is assessed with these variables [6]. In a recent study, the Persian version of the Wolf Motor Function Test (WMFT), one of the common tools used to evaluate the upper limb function of stroke patients, showed reproducibility in evaluating and designing rehabilitation programs to improve the functional abilities of the upper extremities of Iranian patients with stroke [7]. It consists of 15 tasks: 1 to 6 for examining joint-segmental movements, and tasks 7-15 for the functional movements. WMFT is preferable to other upper limb performance tools for stroke patients since it encompasses a wide range of functional tasks (from simple to complex), and evaluates both time and quality of the movement [7, 8]. However, no study has been conducted so far to investigate the relationship between upper limb function using the Wolf scale and the quality of life of patients with stroke [7].

Since upper limb function is essential for many daily activities, it has a prominent role in the quality of life of patients with stroke. Due to the lack of a gold standard test on the upper limb function of stroke patients, we evaluated the construct validity of the Persian version of WMFT, in order to determine the correlation between factors like age, duration of the disease and gender with total functional score and median time of the tasks [6]. Construct validity of a tool refers to the extent to which the scores of that tool represent the intended concept, and its ability to discriminate between groups that differed in the traits under study [7, 9]. In this study, the construct validity referred to a statistically significant correlation between the Persian version of WMFT scores and the physical and mental component summary of the SF-36 Health Survey, which has long been used as a valid and reproducible tool in patients with stroke [8, 9].

Materials and Methods

Study design and study population

The present study was non-experimental with a cross-sectional analytical design in which the construct validity of the Persian version of WMFT was compared with the physical and mental component summary of the SF-36 Health Survey of stroke patients. The patients were recruited by simple non-probability sampling from physiotherapy clinics affiliated to the University of Social Welfare and Rehabilitation Sciences, and from the Shemiranat Welfare Nursing Home. A copy of the Persian version of WMFT with its instructions has been provided in the appendix[1]. The inclusion criteria were 1. History of a single stroke that occurred at least 6 months prior to the study; 2. Over 45 years of age with diagnosis of stroke; 3. Ability to understand oral instructions in Persian; 4. Ability to open the wrists, thumbs, and two other fingers by 10 degrees; and 5. Ability to maintain balance in sitting position.

The exclusion criteria were 1. Previous history of arm or hand disability; 2. Reluctance to participate in the study, 3. Pain in the shoulder and hand, 4. Cognitive impairment; and 5. History of other neurological diseases, including Parkinson disease, multiple sclerosis or traumatic brain injury. Finally, 56 patients with stroke participated in the present study with complete awareness

1. Contact to the following e-mail address to use the questionnaire: ez_kamran@yahoo.com

and consent. Based on the study results of Morris et al. on patients with stroke [10], and with the confidence interval of 95% and test power of 90%, the ideal sample size was 55.3.

Study procedure

After coordination with the clinical staff, all study participants gave their informed consent. The study objectives and procedure were explained to the participants who were completely aware. The participants were first asked questions about the inclusion and exclusion criteria and after fulfilling the required conditions, were enrolled in the study and questioned further.

The 56 included patients were first subjected to the standard test conditions [7], followed by the Persian version of the SF-36 Health Survey (which was standardized in Iran) [9]. This scale has a total of 36 questions divided across two sections, one of physical component summary and another mental component summary, and 8 separate dimensions including physical functioning, limitations due to physical health problems, body pain, general health, vitality, social functioning, limitations due to personal or emotional problems, and mental health perceptions. All these subscales are rated as a standard scale between 0 and 100, with a higher score indicating a better health status [9]. By using the data obtained from this scale, the construct validity of WMFT, as well as the convergence and discriminant validity of the scores compared with the physical and mental component summary of the SF-36 Health Survey were obtained.

The statistical methods used in this study were measures of central tendency and dispersion in order to evaluate the underlying variables of the patients. Shapiro-Wilk test was used to assess normality of the variables' distribution, Mann Whiney U test to evaluate the difference between the total score and the task time of the Persian version of WMFT with sex, cerebral lateralization, and suffered limb, and the Pearson correlation test was used to assess the relationship between the scores obtained from the Persian version of WMFT with the studied variables and the SF-36 physical and mental health sections.

Results

Of the 93 initial patients, 16 were excluded due to cognitive impairment (Mini mental status examination<24), 11 due to severe spasticity of hand and upper limb which prevented them from opening their wrists, thumbs and two other fingers for 10 degrees, 8 due to disability and aging, and 2 for their unwillingness to continue the study. The Persian version of WMFT was then finally tested on 56 patients, including 27(48.2%) women and 29(51.8%) men, and mean (SD) age 67.91(11.08) years (Table 1).

No significant correlation was seen between age, the age of stroke occurrence and duration of the disease with the total functional score and the median time of performing tasks of the Persian version of WMFT (Table 2). In all of these cases, the correlation coefficient was smaller than 0.04 and the level of significance greater than 0.05.

In addition, no significant difference was seen between the sexes in terms of the total functional task score of the Persian version of WMFT. However, the median time of performing tasks was significantly different between the males and females. Finally, no significant difference was seen between the cerebral lateralization and the affected organ in terms of total functional score and the median time of performing the tasks (Table 3).

The convergent validity of the physical subscale scores and the discriminant validity of the mental subscale of the Persian version of the SF-36 scale with the total score and task time of the Persian version of WMFT are shown in Table 4. Although there was a significant statis-

Table 1. Indicators of central tendency and dispersion in the patient variables, and the Shapiro-Wilk test for normality

Variable	No.	Min.	Max.	Range	Mean	Median	SD	Variance	Shapiro-Wilk Significant Level	Distribution
Age, y	56	45.00	90.00	45.00	67.91	66.50	11.08	122.91	0.13	Normal
Age of stroke onset, y	56	42.00	84.00	42.00	63.49	63.00	9.93	98.77	0.39	Normal
Duration of stroke, y	56	1.00	15.00	14.00	4.47	3.00	3.73	13.95	0.008	Abnormal

Table 2. Correlation test of variables with total score and time of performing tasks of the Persian version of WMFT in patients with stroke

Variables	Correlation Coefficient With Total Score	P of Total Score	Difference	Correlation Coefficient With Performance Time	P of Performance Time	Difference
Age	-0.01	0.92	Not significant	-0.008	0.95	Not significant
Age of stroke onset	-0.05	0.67	Not significant	0.04	72.0	Not significant
Duration of stroke	0.05	0.67	Not significant	0.04	0.77	Not significant

tical correlation of the total functional score and the median time of task execution with the physical and mental component summary of the SF-36 Health Survey, no significant converging or discrimination was observed between the same. However, the highest correlation of the total functional score and the median time of executed tasks of the Persian version of WMFT was seen with the total scores of SF-36 Health Survey (r=0.67).

Discussion

The relationship between age and functional activities of patients with stroke is not well known, and studies so far have shown contradictory results [11-13]. Black-Schaffer and Winston showed a significant association of aging with worse outcomes, but in their study, only patients with low scores (less than 40) in Functional Independence Measure (FIM) were examined [14]. In addition, Bugge et al. also concluded that the age and physical function were correlated in patients with stroke, with poorer function seen in older people [15]. The discrepancy in these reports could be due to the complexity and diversity of stroke in terms of type, symptoms, severity, and outcomes. The most influential factor that likely causes disability in stroke patients is the severity of the disease. Unfortunately, due to the lack of a reliable and valid tool, this issue was not investigated [13-15].

We found no significant correlation between the duration of stroke with total functional score and time of executing tasks of WMFT. The minimum and average time of past strokes were 1 and 4.4 years, respectively, among our subjects (Table 2). Since the course of improvement of stroke is at most within 3 to 6 months after the onset of the disease, it is reasonable to improve the physical function of the patients within that duration [11]. On the other hand, one year after the stroke, the condition usually turns chronic, and the course of improvement of physical function becomes very slow or negligible, with no noticeable changes in the patients [15].

There was a significant difference between the sexes in terms of performance time of WMFT in our study. The effect size as determined by the statistical tests was 0.55 with a mean difference of 1.7 s between men and women, and the median performing time of 3.09 s for all tasks. According to the Cohen classification, an effect size of 0.2 was small, 0.5 is moderate, and 0.8 is large. Therefore, although there was a statistically significant difference between the sexes in terms of the median performing time, the time difference was not clinically

Table 3. Relationship between sex, cerebral lateralization, and affected limb with total score and time of performing tasks of the Persian version of WMFT

Variable	Mean Difference	t of Total Score	P of Total Score	Difference	t of Performance Time	P of Performance Time	Difference
Sex	68.1	0.36	0.72	Not significant	2.13	0.04	Significant
Cerebral lateralization	-86.1	1.42	0.16	Not significant	01.51	0.15	Not significant
Affected limb	87.0	0.87	0.39	Not significant	0.93	0.36	Not significant

Table 4. Results of the correlation test between physical and mental subscales of the Persian version of the SF-36 scale with the total score and the task time of the Persian version of WMFT

Subscale	Correlation Coefficient With Total Score	P-Value of the Total Score	Difference	Correlation Coefficient With Performance Time	P-Value of the Performance Time	Difference
Physical functioning	0.52	<0.001	Significant	-0.32	<0.001	Significant
Role limitations because of physical health problems	0.67	<0.001	Significant	-0.39	0.002	Significant
Bodily pain	0.36	0.02	Significant	-0.22	0.09	Not significant
General health	0.66	<0.001	Significant	-0.36	0.005	Significant
Vitality	0.61	<0.001	Significant	-0.42	0.001	Significant
Social functioning	0.58	<0.001	Significant	-0.39	0.003	Significant
Role limitations because of personal or emotional problems	0.41	0.001	Significant	-0.31	0.01	Significant
Mental health perceptions	0.60	<0.001	Significant	-0.38	0.004	Significant
Physical component summary	0.60	<0.001	Significant	-0.40	0.007	Significant
Mental component summary	0.60	<0.001	Significant	-0.41	0.002	Significant
Total score	0.67	<0.001	Significant	-0.42	0.001	Significant

significant [16, 17]. In contrast, Carod-Artal et al. (2000) showed that the level of performance and the quality of life was poorer in the female stroke patients compared to men [17]. Therefore, according to their results, the relationship between sex and physical activity is not unidirectional or known. A possible explanation could be that in addition to type, severity, duration of disease, age and signs of the disease, other influential factors like culture, participation, and responsibility of women and men in daily life activities give rise to such differences [14].

We observed an inverse and moderately significant relationship between the performing time of the Persian version of WMFT, and physical and mental component summary and total scores of SF-36 Health Survey. This means that by improving the physical and mental health of a patient, the time for performing functional activities is reduced (Table 4). In addition, the correlation of the total score of the Persian version of WMFT with the physical component, mental component and total score of SF-36 scale were moderate, moderate and good, respectively.

One of the major goals of the outcome assessment studies is to compare common and specific tools with each other and with other related subscales [5]. For example, in a study by Hacking et al. (2006) on 198 patients with stroke, a strong statistical correlation was seen between physical subscales of general tools of Sickness Impact Profile (SIP), SF-36 and COOP/WONCA (P>0.60), but there was no significant relationship with psychosocial subscale higher than 0.60. Furthermore, in terms of social subscales, only a correlation between social behavior and range of motion in the SIP scale of 0.60 was seen, and no significant correlation was present in other areas. A possible explanation for these contradictory findings is that health is a hypothetical concept without direct

empirical representation. In order to measure this concept, comprehensive physical, psychological, and social dimensions are defined. The content of these dimensions and the choice of more dimensions in the general tools are very different. Researchers mainly focus on the physical dimension since it deals with mobility, but the psychological dimension that incorporates physical, cognitive, behavioral, and emotional components is much more complicated. Furthermore, the social dimension with components such as leisure, household chores, occupation and social encounters, is defined in a wider context. Therefore, it seems logical that the scale score has a high correlation with the total score and mental component summary of SF-36 Health Survey since that also includes physical health and quality of life [1, 6, 18]. Another study has proposed that it is better to use the SIP scale to assess physical health. However, to evaluate the psychological consequences of stroke patients, it is better to use the SF-36 Health Survey, due to its unique contents [19].

In the present study, there was no significant correlation between upper limb function scale (WMFT score) and the physical subscale of SF-36 Health Survey. This could be due to the fact that the SF-36 physical health scale mainly includes questions about mobility, walking, running, and other activities related to the lower limbs, while the only questions related to upper limb functions pertain to daily activities such as bathing/dressing, picking up/carry groceries, displacing a table or vacuum cleaner [9]. In contrast, the scales of Barthel and FIM include the physical activity of both limbs, and therefore, their significant correlation with physical subscales of quality of life questionnaires is predictable. In addition, since upper limb function has received less attention in the SF-36 Health Survey, only a moderate statistical correlation between physical subscale and WMFT is expected [12, 15].

An important factor that was not evaluated in this study was the severity of stroke due to lack of a reliable and valid tool. By assessing the severity, we could examine the discriminant validity of the known clinical groups in WMFT in different degrees of severity [20]. In addition, we could better explain some of the findings in the present study. The upper limb function of stroke patients depends on the duration of disease. The post-stroke duration in this study was at least one year, which was a limiting factor in generalizing the results. Furthermore, our study population did not represent a complete picture of the Iranian stroke patients in terms of economic, cultural and social characteristics. To access such a community, however, we need resources beyond the scope of this study.

Conclusion

The Persian version of WMFT has acceptable construct validity with functional variables and the overall score of the SF-36 questionnaire.

Ethical Considerations

Compliance with ethical guidelines

This research approved by ethical committee of University of social welfare and rehabilitation

Funding

This research did not receive any specific grant from funding agencies

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

The authors would like to express their gratitude to all the patients who participated in the project.

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Appendix 1. The equivalent Persian version without explaining Wolf Motor Function Test

	Task	Functional Score						Time
Simple movements	Forearm to table	0	1	2	3	4	5	
	Forearm to box	0	1	2	3	4	5	
	Extended elbow	0	1	2	3	4	5	
	Extended elbow with weights	0	1	2	3	4	5	
	Hand to table	0	1	2	3	4	5	
	Hand to box	0	1	2	3	4	5	
Functional movements	Reach, catch and drop	0	1	2	3	4	5	
	Lift a can	0	1	2	3	4	5	
	Lift a pencil	0	1	2	3	4	5	
	Pick-up a paper clip	0	1	2	3	4	5	
	Stack checkers	0	1	2	3	4	5	
	Flip cards	0	1	2	3	4	5	
	Turning the key in lock	0	1	2	3	4	5	
	Fold towel	0	1	2	3	4	5	
	Lift basket	0	1	2	3	4	5	

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