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Turkish Version of the Test Your Memory (TYM-TR) as a Screening Tool in Memory Clinics

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Abstract

Introduction: This study compared the Turkish version of Test Your Memory (TYM) MMSE (Mini-Mental State Examination) and CDT (Clock Drawing Test) in patients with neurocognitive disorder. **Methods:** After a thorough medical workup, patients with a diagnosis of neurocognitive disorder were enrolled. A cross-sectional design was used to compare the TYM results with those of MMSE and CDT. **Results:** This study was conducted on 100 patients, including 46 males and 54 females, aged 52 to 86. The majority of patients were diagnosed with vascular neurocognitive disorder. The z-score of TYM-TR was significantly lower in the domains of registration, recall, visuospatial, and total score. The same results were achieved when CDT was added to MMSE. The same pattern was observed separately for those who were diagnosed with a mild or major neurocognitive disorder. **Conclusion:** Patients' cognitive deficits might be more evident when measured by the TYM-TR compared to the MMSE.

Keywords

aged, cognition, dementia, mental status standards, screening

Introduction

The population worldwide is aging rapidly, particularly in developed countries, and will pose challenges for health care systems. One of the problems is dealing with the enormous resources required to provide care for patients with cognitive decline, impacting patients and families. Early recognition is one of the most critical steps for appropriate treatment and meticulous research. The most beneficial approach for timely detection might be the use of valid screening tools.

In response to having a "practical method" for scoring cognitive abilities, the Mini-Mental State Examination (MMSE) was developed in 1975[1] and is still used as the most popular screening tool in clinical practice to assess people with dementia worldwide, including Turkey. Although the MMSE provides valuable information to detect patients displaying early signs of cognitive decline, false-negative results might be challenging in patients with high premorbid intelligence or those highly educated.

Another well-known tool for the same purpose is the Clock Drawing Test (CDT) developed by Pinto & Peters in 2009.[2] Cognitively impaired patients, especially those with Alzheimer's disease (AD), can be successfully screened using cognitive screening tools, especially when used in combination. A

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reasonable specificity was observed when using a combination of the MMSE and CDT to screen patients with AD.[3] Again, some disadvantages are observed, like lower sensitivity to the early changes in highly educated individuals[4,5] and low sensitivity to detect mild forms of AD.[6]

Test Your Memory (TYM) was introduced as an alternative tool, especially to meet the criteria of minimal operator time to administrate, test a reasonable range of cognitive functions, and be sensitive to mild AD.[7] The TYM has been translated into several languages like Japanese, Polish, and French.[8-10] The Turkish version of TYM (TYM-TR) was introduced by Maviş et al. With internal consistency of $\alpha = 0.85$, reliability of 0.97, sensitivity of 96.61% and a specificity of 96.13% for detecting dementia.[11]

Specialized clinics face the demand for reliable screening tools to serve the developing and aging community. In search of overcoming the limitations of MMSE mentioned above, this study aimed to evaluate the efficacy of TYM-TR in patients with dementia and compare the results with MMSE and CDT.

Materials and Methods

Setting

This study was conducted in the neurology clinic of Eskişehir Osmangazi University. Written informed consent was obtained from all participants (or their guardians) to enter the study, explaining that cognitive tests would be carried out as the usual process of their medical workup, and data would be used anonymously for research purposes. A cross-sectional design was used to compare the TYM results with results of MMSE and CDT.

Study Sample

Patients with a diagnosis of a neurocognitive disorder, based on the criteria of Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) were included and classified regarding severity (mild and major neurocognitive disorder), and subtypes of neurocognitive disorder due to Alzheimer's disease, frontotemporal neurocognitive disorder, a neurocognitive disorder with Lewy bodies, vascular neurocognitive disorder, a neurocognitive disorder due to Parkinson's disease and neurocognitive disorder due to multiple etiologies.

The diagnostic process began by taking a medical history, and a thorough medical examination was performed for all patients, including a neurological examination and a structured psychiatric interview by a specialized neurologist and psychiatrist in the field of dementia. Complementary laboratory investigations and brain imaging were performed by magnetic resonance imaging in T1, T2, Flair, D/W, and ADC pulse sequences. Based on the results of these evaluations, medical and psychiatric conditions affecting the patients' cognitive performance were assessed and excluded. This involved intellectual disability, severe and uncorrected visual and hearing problems, multiple sclerosis, vasculitis, major depressive disorder, psychotic disorders, delirious state for any reason, and taking illegal substances or tranquilizers. Patients were enrolled regardless of their treatment course; therefore, the sample included those who had already started treatment and newly diagnosed and drug-naïve patients.

Cognitive Assessments

After reaching the diagnosis, the patients were referred for cognitive evaluation with 3 different tools, performed within one day. Trained psychiatrists performed the tests alternatively for each test (TYM and MMSE+CDT) while they were blinded to the results of the other test.

Mini-Mental Status Examination (MMSE)

MMSE is one of the most widely used tools for assessing cognitive functioning when considering a diagnosis of dementia.[12] It is a paper-based test with a maximum score of 30, with lower scores indicating more severe cognitive difficulties. The score of 24 is usually accepted as the cut-off point for the MMSE for a "normal" cognitive function; however, careful consideration should be given to interpreting the results, especially in a clinical setting.[13] The test domains were orientation, registration, attention, calculation, recall, language, and visuospatial ability.

Test Your Memory (TYM)

TYM is a self-report screening tool, usually taking 5 minutes to complete. The TYM consists of assessing 11 cognitive domains of orientation, registration, semantic memory, calculation, verbal fluency, abstraction, naming, visuospatial abilities, anterograde memory, and executive functioning. It scores between 1 and 50, with lower scores indicating more severe cognitive problems. The cut-off point of 34 has been suggested for the Turkish version.[11]

Clock Drawing Test (CDT)

CDT is a widely used and sensitive test for detecting dementia. In this quick and simple nonverbal screening tool, the patient is asked to draw a clock and is supposed to place the numbers around the circle using planning, visual-spatial, and numerical sequencing abilities. Drawing the hands for a specific time also evaluates long-term attention, memory, auditory processing, motor programming, and frustration tolerance.[14] The total score can be 7, depending on how the analog clock and the appropriate markings were drawn.

Statistical Analysis

Data were analyzed with SPSS 23. The normality of distribution was checked by the Kolmogorov-Smirnov test. The raw data are presented in mean $\pm$ standard deviation or number (percentage) where appropriate. Scores of TYM and MMSE are presented as a score of each subscale (orientation, registration, calculation, recall, and visuospatial) and also as the total score. These scores were also converted to z-scores and compared within each domain using a paired t-test. The linear

Table 1. Demographics and Type of Neurocognitive Disorders in the Study Sample.

Mean age ± SD	70.07 ± 9.48	
Female:male	1:1.2	
Highest educational level		
Elementary school	64%	
Middle school	7%	
High school	17%	
Associate's degree	4%	
Bachelor's degree	4%	
Master's degree	4%	
Right handedness	98%	
Neurocognitive Disorder	Mild	Major
Neurocognitive Disorder due to Alzheimer's Disease	16	21
Vascular Neurocognitive Disorder	14	30
Frontotemporal Neurocognitive Disorder, Behavioral Variant	4	9
Neurocognitive Disorder with Lewy Bodies	2	3
Frontotemporal Neurocognitive Disorder, Language Variant	0	1

Table 2. Mean Values for Z-Scores Obtained From MMSE and TYM-TR.

Cognitive domains	TYM-TR	MMSE	T-value	P-value
Orientation	7.21 ± 2.88	7.38 ± 2.93	1.05	0.147
Registration	2.34 ± 1.21	2.91 ± 0.55	4.91	0.0001
Calculation	3.2 ± 2.03	3.44 ± 1.96	1.1	0.136
Recall	0.54 ± 0.95	1.28 ± 1.09	6.54	0.0001
Visuospatial	Drawing M Letter 0.89 ± 1.24	1.8 ± 1.53	5.92	0.0001
	Clock Face 2.5 ± 1.59	2.4 ± 2.05	−0.64	0.73
Total Score	27.8 ± 13.43	MMSE 37.71 ± 10.47	13.21	0.0001
	27.8 ± 13.43	MMSE + CD 34.39 ± 14.39	10.99	0.0001

correlation between these 2 measures was also assessed using Pearson's correlation coefficient. A P-value of <0.05 was considered significant.

Results

This study was conducted on 100 patients, including 46 males and 54 females, aged 52 to 86. Table 1 describes demographics and the severity and type of neurocognitive disorders in the patient group diagnosed according to DSM-5. The majority of patients were diagnosed with a vascular neurocognitive disorder (44%), followed by neurocognitive disorder due to Alzheimer's disease (37%), frontotemporal neurocognitive disorder (14%), and neurocognitive disorder with Lewy bodies.[5] These patients were categorized to have mild (36%) and major neurocognitive disorder (64%) described in Table 1 for each diagnosis.

Table 3. The Linear Correlation Between Scores of Patients in Domains of TYM-TR and MMSE by Pearson Correlation.

Cognitive domains in TYM-TR and MMSE	Pearson correlation	P-value
Orientation	0.846	0.0001
Registration	0.318	0.001
Recall	0.396	0.0001
Calculation	0.409	0.0001
Visuospatial Drawing Letter	0.405	0.0001
Visuospatial Clock Face	0.653	0.0001
Total Score	0.831	0.0001

The MMSE score was <24 in 45 patients, while 59 patients scored <34 in TYM-TR. Therefore, 18 patients scored >24 in MMSE but scored lower than the cut-off in TYM.

Table 2 shows the mean values for z-scores obtained from MMSE and TYM-TR and compares the cognitive domain and the total score. As shown in the table, the z-score of TYM-TR was significantly lower in the domains of registration, recall, and visuospatial (measured by letter M drawing item) and the total score. The total z-score of TYM-TR was also compared to the total z-score of MMSE plus z-score of Clock Drawing test, which was again significantly different, and patients scored lower in TYM-TR.

We also compared the total z-score of MMSE and TYM-TR separately for those diagnosed with a mild or major neurocognitive disorder. The same pattern was observed, and the mean z-score of TYM-TR was significantly lower than the MMSE in both forms.

We also evaluated the linear correlation between the scores of the 2 tests. As described in Table 3, there was a strong correlation between total and orientation scores and a moderate correlation between visuospatial and calculation scores, while scores of registration and recall correlated weakly.

Discussion

This study was the first to compare the ability of MMSE and TYM-TR to evaluate patients with cognitive decline and showed that in the presence of cognitive decline, the score of TYM-TR decreased in the domains of registration, recall, and visuospatial ability, possibly being more sensitive to changes compared to MMSE.

A valid screening tool for detecting cognitive decline plays a vital role in providing the best service for patients with dementia.[15] Clinicians prefer to administer simple tools that give the most critical information. The MMSE continues to be the most popular screening tool in clinics. The MMSE offers modest accuracy in specialist settings, with the best value for screening dementia in the community and primary care.[16] False-negative results are challenging in highly educated people in the developing world, which provides increased access to higher education. Moreover, the MMSE does not detect problems in executive functioning.[17] The TYM-TR could be a suitable

Table 4. Detailed Results of The Pearson Correlation in Compared Domains of TYM-TR and MMSE.

Compared cognitive domains in TYM-TR and MMSE	Pearson Correlation of TYM-TR and MMSE	P-value
Orientation	0.846	0.0001
Registration	0.318	0.001
Recall	0.396	0.0001
Calculation	0.409	0.0001
Visuospatial Drawing Letter	0.405	0.0001
Visuospatial Clock Face	0.653	0.0001
Total Score	0.831	0.0001

replacement designed to be used by a non-specialist and evaluates a reasonable series of cognitive functions.

According to our findings, patients with neurocognitive disorder (with different severity) scored lower in TYM-TR than MMSE. Since we compared the standardized scores, this difference means that a patient receives a lower score of TYM task compared to MMSE, gets diagnosed with milder impairments, and is less likely to be missed. Tasks for evaluating registration, recall, and drawing the letter M were more sensitive than matching items in MMSE. The same conclusion has been reported from a study that evaluated patients with Alzheimer's disease and healthy controls.[7] Another study evaluating healthy people and patients with recently established clinical diagnostic criteria of MCI, AD, and vascular dementia, also reported that TYM is more suitable as a practical tool for the early detection of dementia compared to the MMSE.[18] Our results indicate that the Turkish version has the same capacity.

In addition, the TYM-TR has some advantages compared to the MMSE by evaluating cognitive domains like verbal fluency, abstraction, and semantic memory, and needs an intact executive functioning to perform visuospatial tasks (drawing the letter M and drawing a clock face). These items increase the chance of detecting less common forms of dementia, like neurocognitive disorder with Lewy bodies, a neurocognitive disorder due to Parkinson's disease, neurocognitive disorder, and frontotemporal neurocognitive disorder.

However, these properties are associated with the preservation of other advantages of MMSE. According to our findings, TYM-TR behaves similar to MMSE in diagnosing cognitive deficits. Pearson's correlation of similar cognitive domains is significant, according to Table 4. A lower correlation was seen in the fields where TYM-TR is more sensitive and challenging, like registration and recall. This correlation between TYM-TR and MMSE was also reported in the study which introduced the Turkish version of TYM.[11] The study evaluated 59 patients with dementia aged over 60, and compared results of MMSE and TYM-TR. The current study which had a higher sample size, not only added CDT to the cognitive evaluation, but compared performance of participants in each of cognitive domain domains tested by these tools too.

This study used standard questionnaires and specialized skilled clinicians as the strong points, but it also had some limitations. The number of patients with higher education was limited, making it impossible to analyze their performance separately from those with a lower educational level. This can be addressed in further studies. We also did not record the duration of the cognitive problem. This duration can always be biased by patients' living conditions, family members' attention, and cognitive demands of their daily living. Since each patient's performance in the 2 tests was compared, the results could not be influenced by this issue. However, further studies can limit patients to specific stages of illness and add to the available evidence.

Conclusion

TYM-TR is a suitable screening tool in detecting subtle cognitive deficits of neurocognitive disorders. Cognitive deficits of patients might be more noticeable when measured by the TYM-TR compared to the MMSE.

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Declaration of Conflicting Interests

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