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Research Article

The Validity and Reliability of the Turkish Version of the Rowland Universal Dementia Assessment Scale (RUDAS) for Alzheimer's Disease and Mild Cognitive Impairment

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Abstract

Background: With demographic aging, the frequency of cognitive and behavioral disorders gradually increases. Screening tests, which are simple to perform, help detect dementia for the clinician. The Rowland Universal Dementia Assessment Scale (RUDAS) is a screening test developed in Australia, where people from many cultures and languages live together, and it is stated that it is not affected by language and education level. Our aim in this study is to create a wider field of use by evaluating the patients with mild cognitive impairment of this test, whose Turkish validity and reliability study has been done previously for Alzheimer disease patients.

Method: The study group was composed of a group with Alzheimer's disease (n = 87), with a diagnosis of mild cognitive impairment (n = 95), and a non-dementia control group (n = 80) with similar age, education level, and gender distribution Mini-mental status exam (MMSE) and RUDAS were applied to the patients and the control group. Tests were re-administered seven days later for test-retest evaluation for reliability tests. The internal consistency coefficient was calculated. For validation, patient groups and control group were compared. For parallel test validity, MMSE and RUDAS scores were compared. For time validity, first day and seventh day scores were compared.

Results: The Cronbach alpha coefficient of the RUDAS scale is 0.8529. In our analysis, the scale was found to be highly reliable. In our study, the difference between the RUDAS scale mean scores of the groups was found to be statistically significant ($p<0.001$). In estimating the Alzheimer's Disease patient group, the AUC value under the curve of the RUDAS score was obtained as 0.998, and the mild cognitive impairment AUC value was obtained as 0.971, which was found to be significant. ($p<0.001$). The degree of the relationship between the RUDAS scale and the MMSE scale was found to be very strong and statistically significant in the positive direction. ($r=0.938$ $p<0.001$)

Conclusion: This study showed that the Turkish version of the RUDAS is a valid and reliable scale for the evaluation and follow-up of Alzheimer's disease and mild cognitive impairment in the Turkish population.

Keywords: Dementia, Alzheimer's Disease, RUDAS, neuropsychological tests, neurocognitive disorders

INTRODUCTION

Dementia is a neuropsychiatric disease that manifests with the gradual deterioration of cognitive functions. The prevalence of dementia varies according to geographical regions and socioeconomic levels of societies. Age, education, and gender are determinants in the formation of dementia. The incidence of dementia increases with advanced age and low education level. Screening tests are frequently used to detect cognitive impairment at an early stage and to evaluate cognitive disorders in epidemiological studies. The most commonly used screening test is the Mini-mental status exam which has been validated for the Turkish population and used in outpatient clinics[1,2]. However, language and education level affect the results of this test[3,4]. The Rowland Universal Dementia Assessment Scale (RUDAS) is a neuropsychological test developed in 2003 in Australia, mainly because of the high socio-cultural difference. The RUDAS contains six items that assess body orientation, praxis (alternating hand movements), drawing (copying of a cube), judgment (in relation to crossing a busy road), memory (4-item grocery recall), and language (animal fluency). It has a score interval of 0–30 points, takes approximately ten minutes to administer[5].

Since Turkey has a very high demographic diversity, this test will be helpful for clinical diagnostic purposes in terms of intelligibility and applicability compared to other tests for Turkey.

Our main aim in this study is to perform the validity and reliability study of the RUDAS for the Turkish population and to evaluate the discrimination power in patients with alzheimers disease and mild cognitive impairment (MCI).

MATERIALS AND METHODS

Patients

Patients who were diagnosed and treated at Başkent University Faculty of Medicine Neurology Department between 2009 and 2011 were included in the study. 95 patients diagnosed with Alzheimers disease (AD) according to the National Institute of Neurological and Communicative Diseases and Stroke/Alzheimer's Disease and Related Disorders Association (NINCDS-ADRA) and Diagnostic and Statistical Manual of Mental Disorders IV (DSM IV) criteria, and 88 patients diagnosed with MCI according to Petersen criteria were included in the study[6,7]. A control group of 80 people without dementia, with similar age, education level, and gender distribution, was used for standardization tests. Patients with advanced disease, which would cause additional cognitive impairment, and who could not cooperate with the test were excluded from the study. The baseline demographic and clinical characteristics of the patients are shown in Table 1.

RUDAS test was translated into Turkish, three researchers with a good level of English translated independently from each other. Then they back-translated into English by three independent researcher. RUDAS and MMSE were applied to all study group and tests were re-administered seven days later for test-retest evaluation for reliability tests.

Statistical analysis

Data were analyzed with IBM SPSS V23. Conformity to normal distribution was evaluated with the Kolmogorov Smirnov test. Mann Whitney U test was used to compare the data that were not normally distributed according to the paired groups and multiple comparisons examined with Dunn's test. The Wilcoxon test was used to compare the test and retest scores within the groups, and the intraclass correlation coefficient (ICC) was used to examine their agreement. Spearman's rho correlation coefficient was used to examine the relationship between non-normally distributed scores. Analysis results were presented as mean ± standard deviation and median (minimum – maximum) for quantitative data, and frequency (percent) for categorical variables. Significance level $p<0.05$ was taken. The internal consistency coefficient was calculated. For validity tests, comparisons of Alzheimer's patients, and mild cognitive impairment patients were made. compared with MMSE for parallel test validity. An evaluation was made using the ROC curve for discrimination. In addition, sensitivity and specificity assessments were performed.

RESULTS

Reliability

The Cronbach alpha coefficient of the RUDAS scale is 0.8529. When the test-retest reliability was evaluated between the groups, a statistically significant, perfect level of agreement was obtained between the test and retest values in the AD group. ICC: 0,99 (0,985- 0,994) ($p<0,001$). A statistically significant agreement was obtained between test and retest values in the MCI group. ICC: 0,929 (0,894- 0,953) ($p<0,001$). A statistically significant, perfect agreement was obtained between the test and retest values in the control group. ICC: 0,899 (0,843- 0,935) ($p<0,001$).

Validity

A statistically significant positive correlation was found between RUDAS and MMSE in the AD group in the evaluation made for parallel test validity. ($r=0,938$; $p<0,001$) A statistically significant positive high correlation was found between RUDAS and MMSE in the MCI group. ($r=0,635$; $p<0,001$) A statistically significant positive correlation was found between RUDAS and MMSE in the control group. ($r=0,604$; $p<0,001$). (Table 2)

When the first and second application results were evaluated, the significant and high correlation for all three groups was found to be significant in terms of time validity.

Sensitivity, Specificity, PPV, and NPV

ROC analysis was used to estimate the AD group. The AUC value under the curve of the RUDAS score was 0.998, which was statistically significant ($p<0.001$). When the cut-off value is taken as 23, the sensitivity value is 98.85%, the specificity value is 100%, the PPV value is 100%, and the NPV value is 98.8%. (Figure 1) In estimating the MCI patient group, the AUC value under the curve of the RUDAS score was obtained as 0.976 and was found to be statistically significant ($p<0.001$). When the cut-off value is taken as 25, the sensitivity value is 93.7%, the specificity value is 90%, the PPV value is 91.8%, and NPV value is 92.3%. (Figure 2) (Table 3)

Table 1: The Baseline Demographic and Clinical Characteristics of the Patients.

	(n) / Mean ± SD
Group	
AD	*87*
MCI	*95*
Control	*80*
Age	*69,81 ± 10,69*
Education	
5 years	*93*
8-11 years	*96*
12 years	*73*
Gender	
Female	*131*
Male	*131*

AD (Alzheimer Disease) , **MCI** (Mild Cognitive Impairment)

Table 2: Relationship between RUDAS and MMSE

Group		MMSE	
		r	p
AD	RUDAS	0,938	**<0,001**
MCI	RUDAS	0,635	**<0,001**
Kontrol	RUDAS	0,604	**<0,001**

r: Spearman's rho correlation coefficient

Table 3 :ROC analysis results of RUDAS and MMSE scores in predicting AD, MCI and patient groups

Group		Cut-off value	AUC (%95 CI)	p	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
AH	MMSE	≤23	1 (0,999 - 1)	**<0,001**	98,85%	100%	100%	98,77%
	RUDAS	≤23	0,998 (0,993 - 1)	**<0,001**	98,85%	100%	100%	98,77%
MCI	MMSE	≤26	0,971 (0,948 - 0,994)	**<0,001**	100,00%	90%	92%	100,00%
	RUDAS	≤25	0,976 (0,958 - 0,993)	**<0,001**	93,68%	90%	92%	92,31%

Table 4: Comparative Test Results By Gender

Diagnosis		Female	Male	p
MCI		Median [Q1-Q3]	Median [Q1-Q3]	
	MMSE	18[12.5-21]	18.5[12-21]	0.969
	RUDAS	15[10-20]	15.5[10-19]	0.844
AD	MMSE	24[23-26]	25[24-25]	0.991
	RUDAS	23.5[22-24]	23[21.5-24]	0.606

MMSE = Mini Mental State Examination; RUDAS = Rowland Universal Dementia Assessment Scale; MCI = Mild Cognitive Impairment; AD = Alzheimers Disease

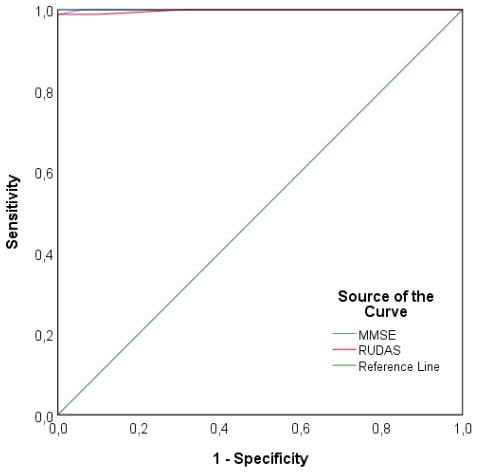

Figure 1: ROC curve for AD

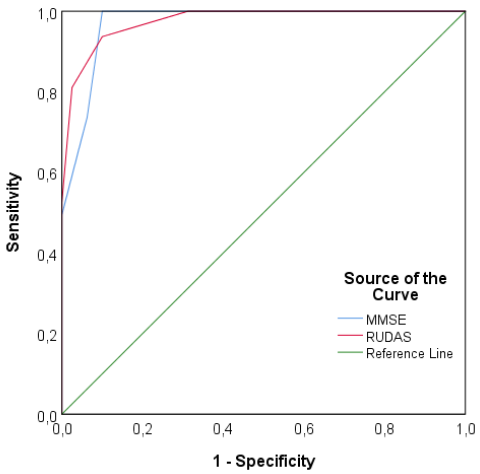

Figure 2: ROC curve for MCI

DISCUSSSION

RUDAS was first developed in 2003 by Storey and Rowland in Australia. It was aimed by researchers to be a short-term test for multicultural societies that would not be affected by language, education and cultural differences. The original development study was conducted with a control group of 45 with dementia, with a mean age of 77.9 years and an average of 9 years of education. The ROC curve was used for diagnostic validity, the cut-off value was 23, and sensitivity specificity was detected in the diagnosis of dementia

89% (95% CI 76%–96%) and 98% (95% CI 88%–97%)[5]. A validation study was conducted with MMSE in 2006, and similar sensitivity and specificity were found with MMSE. Similarly, in our study, the cut-off value was found to be 23. (95% CI 98.85% - 100%). The most critical limitations stated in the original study were that the dementia stages of the patients were more advanced than the average population and that they could not adequately evaluate MCI patients. As a result, they stated that they could distinguish between dementia at least as much as the MMSE and evaluate the frontal lobe functions better than the MMSE. In addition, they stated that the test could be translated into other languages without loss of meaning[8].

RUDAS has been validated with various cognitive tests translated into many languages since then[9-16]. Turkish validation by Ayan et al. made in 2019. DSM 5 criteria were used in Turkish validation. Although adequate validity and reliability criteria for significant cognitive impairment were met in the Turkish validation study, it was emphasized that a cut-off value and validity study was needed for MCI patients[15]. Since there is no definitive diagnostic test for mild cognitive impairment, we aimed to calculate a cut-off value for patients with MCI, whom we evaluated based on Petersen criteria[7]. In our study, when the cut-off value was taken as 25, it was determined that the RUDAS test could be successful in distinguishing MCI. (95% IC 93,68%-90%). When we do a literature review only five of the 21 samples reported diagnostic performance of the RUDAS for the detection of MCI. The combined data from these samples gave a pooled estimate of .80 (95% CI, .58–.92) for sensitivity and.79 (95% CI, .63–.89) for specificity[17]. In a study in Thailand MCI diagnosis was very good based on the AUC (0.82), and the optimal cutoff point was 25/30[9]. However, the limitation of our study on this subject can be considered as the inadequacy of MMSE for MCI patients. MCI diagnosis was primarily on the clinical decision without the available laboratory test. MCI definition according to Peterson criteria; It can be defined as the group of patients who have memory loss detectable by neuropsychological tests but do not meet the diagnostic criteria for dementia. In addition, the use of biomarkers as an additional diagnostic test could be more decisive but due to the difficulty of accessing biomarker tests and their high cost, their use is still very limited.

In our study, when we compared the RUDAS subscale scores at all three education levels, we found that it was not affected by the education level. The fact that we classified the patient and control groups as similar in age and education level added strength to our study. In addition, we have contributed to the literature by evaluating MCI patients as a different group. However, we concluded that it would not be accurate to reach a definite conclusion since the patients were compared with the MMSE, and validation with additional tests is required.

Similar to the original study, there was no difference between gender in our study (Table 4). Ten studies investigated the effect of gender, a cross-European study found a significant effect but with a very small effect size (R2 = .01) in literature[16].

CONCLUSİON

Since it is challenging to make a differential diagnosis of dementia in countries without a high level of education and culture, short assessment scales are beneficial, especially in intensive outpatient clinics, due to the necessity of making a diagnosis in a short time. RUDAS may be a good option for the differential diagnosis of dementia, as the MMSE is a test that has been used for a long time and is affected by various sociodemographic factors. More accurate results can be obtained by combining them with other tests to evaluate mild cognitive impairment.

Author Contributions

All authors contributed to writing this study and have approved the final version. Data sharing: corresponding author could provide underlying research materials related to the article.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Committee Approval

Approvel for this prospective study granted by Instutitional Review Board of Baskent University. (Approvel Code: KA09/445)

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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