Determination of cut-off values of tinetti performance oriented mobility assessment and fall risk questionnaire in older adults individuals with cognitive impairment

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Abstract

Aim: This study was planned to determine cut-off values of the Tinetti Performance Oriented Mobility Assessment (POMA) and the Self-Assessment Fall Risk Questionnaire (FRQ) in older adults with mild cognitive impairment.

Material and Methods: This study included a total of 213 individuals aged 65 years and over in the study. These individuals were divided into two groups according to Mini Mental Test (MMT) scores: 116 individuals with an MMT score of 18-23 (mild cognitive impairment) and 97 individuals with an MMT score of 24 or more (normal cognitive function). Balance and gait performance was assessed by the POMA, the fall risk self-assessment by older adult susing a FRQ.

Results: In Older Adults with mild cognitive function, the clinical cut-off points for the POMA and FRQ were determined according to ROC curve analysis. The clinical cut-off point for the POMA was determined as 15.5 points; and 15.5 points or more in the POMA were considered normal with a 95% confidence level. The clinical cut-off point for the FRQ was determined as 4.5 points; and 4.5 points or less in the FRQ were considered normal with a 95% confidence level.

Conclusions: We think that it is important to take the values obtained in the present study into account in interpreting the above-mentioned commonly used tests when cognitive status is considered related to falling. Therefore, it is suggested that these tests used in the clinic should be examined considering the risk of falling in older adults with mild cognitive function.

Keywords: Older Adults;Tinetti Performance Oriented Mobility Assessment; Fall Risk Questionnaire; Cut-Off.

INTRODUCTION

Maintaining physical function independently is important throughout life. Sufficient lower limb strength, safe and adequate gait, and good balance function are required for an independent function (1,2). A good balance is necessary to carry out daily living activities successfully. Balance is the ability of a person to maintain his or her position at various positions (3). Balance is achieved by the contributions of vision, vestibular system, proprioception, reaction time, and muscle strength. Gait and balance usually change with aging (4). Balance problems can also occur due to aging-related impairments and physiological losses that can develop in the functions of systems which contribute to balance formation. Since balance problems lead to falls, they pose an important health problem, especially in regions where older adults population lives intensely (3,5). Except for balance problems, many problems increase the risk of falling in the Older Adults.

Depression, hearing loss, visual loss, dizziness, drug use, loss of strength, supportive use, and cognitive impairment are factors that increase the risk of falling (6-8).

Cognitive functions of individuals decrease with aging. Mild cognitive function causes balance and mobility deficits. This reduces physical activity that individuals do during their daily life activities (9). For this reason, a reliable clinical measurement to assess balance is important in determining the elderly with a risk of falling (10). Performance-based measurements used in the assessment of balance include sitting and standing balance test, sternal push test, and bend-reach test (11). The POMA can be applied for assessing both balance and gait performance (12). The FRQ is a simple and rapid test that assesses the risk of falling in the older adults. This study was planned considering the fact that POMA and the FRQ did not have cut-off values in older adults with mild cognitive impairment in the literature.

MATERIAL and METHODS

This study included a total of 213 individuals aged 65 years and over who were admitted to Kirikkale High Speciality Hospital, Community Mental Health Center and who agreed to participate in the study. This study was conducted by momentary condition detection method, a single-screening model, one of general screening models. The subjects were reached by accessible (impartial) sampling method. These individuals were divided into two groups according to Mini Mental Test (MMT) scores: 116 individuals with an MMT score of 18-23 (mild cognitive impairment) and 97 individuals with an MMT score of 24 or more (normal cognitive function).

Patients who had cognitive, orthopaedic, and neurological problems that affected the determination of balance and functional performance, who had uncontrolled cardiovascular and chronic diseases, and who used auxiliary tool to maintain functional independence were excluded from the study.

This study was approved by Kirikkale University Clinical Research Ethics Committee Decision No: 06/11). Informed Consent Forms were signed by all voluntary individuals included in the study.

Within the scope of the evaluations,the interviews were done face-to-face with the individuals. The socio-demographic characteristics of the individuals such as age, gender, height, and weight were recorded. Body Mass Index (BMI) was calculated using the following formula: weight (kg)/height (m)² (kg/m²). Balance and gait performance was assessed by the POMA. The risk of falling was assessed by the FRQ. Cognitive status was assessed by the MMT.

Tinetti Performance Oriented Mobility Assessment (POMA)
This test is composed of two distinct components, including a balance subscale (9 items, 16 points) and a gait subscale (8 items, 12 points). The maximum possible score is 28 points (13). Higher scores indicate better balance and gait performance. The group at the highest risk obtains the lowest scores (≤18). The group at moderate risk consists of people with scores between 19-23 points, which reflects moderate dependence and fall risk. The group at minimal risk is the one with scores of ≥24 points (14). This is a test that has the Turkish version, and that is valid and reliable for older adults (15).

Fall Risk Self-Assessment Questionnaire (FRQ)
It is a scale that measures fall risk in the elderly. It consists of 12 items that assess fall risk in the elderly.It is designated as "yes" (1 point) or "no" (0 points). Elderly people with a score of 4 points or more are classified as having high fall risk (16).

Mini Mental Test (MMT)
The Mini Mental Test (MMT) is a commonly used test that can be easily applied within 5-10 minutes to assess cognitive functions of older adults. The MMT is subdivided into 5 components: orientation (10 points), enrolment memory (3 points), attention and calculation (5 points), recall (3 points) and language (9 points).It contains 11 questions and provides a total of 30 points. Scores are interpreted as follows: 24-30=no impairment; 18-23=mild impairment, and 0-17=severe impairment. This is a test that has the Turkish version, and that is valid and reliable for older adults (17,18).

Statistical analysis
Statistical analyses were performed using the SPSS 16.0 Program. The normal distribution of the variables was tested by visual (histogram and probability plots) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). In order to compare the differences between individuals with an MMT score of 18-23 and individuals with an MMT score of 24 or more, the Independent Samples t-test was used for continuous variables, and the Chi-square Test was used for categorical variables. Receiver Operating Characteristic (ROC) Curve Analysis was used to assess the diagnostic validity of the POMA and the FRQ in older adults with cognitive impairment. The highest combination of sensitivity and specificity was taken to determine the optimal cut-off value for each test.

The descriptive information of the older adults with mild cognitive impairment and normal cognitive function are shown in Table 1.

Table 1. The descriptive information of the Older Adult swith mild cognitive impairment and normal cognitive function					
	Normal Cognitive Function (n=97)		Mild Cognitive Function (n= 116)		
	Mean ± SD	Med (Min-Max)	Mean ± SD	Med (Min- Max)	p
Age (years)	69.44 ± 5.01	68 (65-89)	71.44 ± 6.37	70 (65 - 93)	0.023*
BMI (kg/m²)	28.58 ± 4.24	28.06(18.67-43.37)	29.09 ± 5.34	28.94 (17.78-42.22)	0.438
POMA	22.52 ± 5.18	24 (10 - 28)	19.05 ± 6.85	20 (3 - 28)	0.0001*
FRQ	2.99 ± 2.49	3 (0 - 10)	5.58 ± 3.54	5 (0 - 12)	0.0001*
*p<0.05, BMI: Body Mass Index, POMA:Tinetti Performance Oriented Mobility Assessment, FRQ: Fall Risk Questionnaire					

In older adults with mild cognitive function, the clinical cut-off points for the POMA and FRQ were determined according to ROC curve analysis. The clinical cut-off point for the POMA was determinedas 15.5 points. 15.5 points or more in the POMA were considered normal with a 95% confidence level. The POMA appeared to have a high discriminatory power for older adults with cognitive impairment (95% Confidence interval lower bound=0.579 upper bound= 0.724; Area Under the Curve (AUC) = 0.651; Std. error=0.037; P=.0001) (Figure 1).
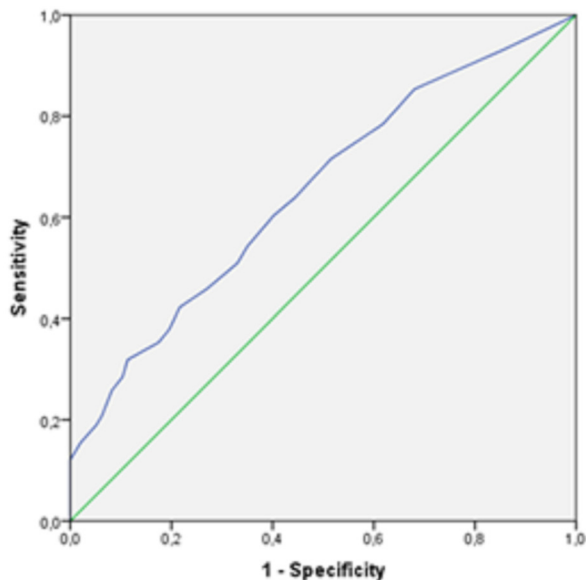

Figure 1. POMA were determined according to ROC curve

The clinical cut-off point for the FRQ was determinedas 4.5 points; and 4.5 points or less in the FRQ were considered normal with a 95% confidence level. The FRQ appeared to have a high discriminatory power for older adults with cognitive impairment (95% Confidence interval lower bound= 0.644 upper bound= 0.781; Area Under the Curve (AUC)= 0.712; Std. error= 0.035; P=.0001) (Figure 2).
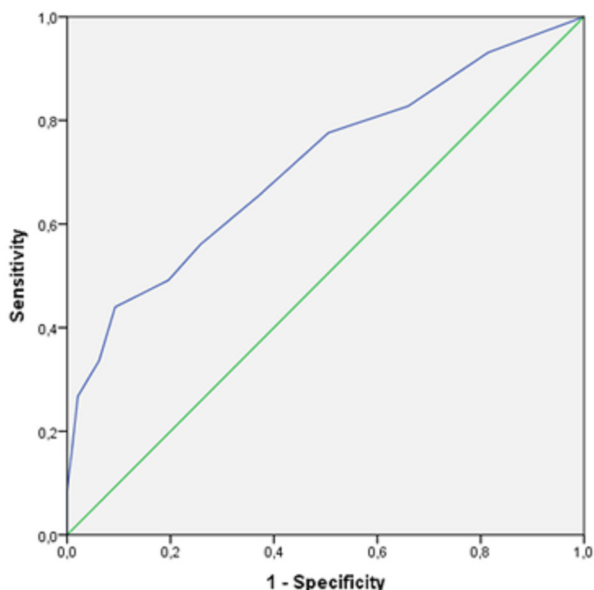

Figure 2. FRQ were determined according to ROC curve

Sensitivity, specificity, negative and positive predictive values for the POMA and FRQ are shown in Table 2. It is noteworthy that the POMA and FRQ have high specificity.

Table 2. Sensitivity, specificity, negative and positive predictive values for the POMA and FRQ in Older Adults Individuals With Cognitive Impairment

	Sensitivity (%)	Specificity (%)	Negative Predictive Values (%)	Positive Predictive Values (%)
POMA	31.90	88.66	52.12	77.08
FRQ	56.03	74.23	58.54	72.22

POMA: Tinetti Performance Oriented Mobility Assessment, FRQ: Fall Risk Questionnaire

DISCUSSION

This study is important for revealing the clinical cut-off values of the POMA and FRQ in older adults with mild cognitive impairment.

Tinetti et al. reported that the cut-off value, sensitivity, and specificity of the Tinetti POMA in older adults were 10, 80.0% and 74% (19). Sterkeet al. determined that the cut-off value, sensitivity, and specificity of the Tinetti POMA in 75 older adults with dementia were 21, 85% and 56% . They have emphasized that high sensitivity is more important in terms of early identification and intervention in patients with low specificity (20). Harada et al. found that the cut-off value, sensitivity, and specificity of the Tinetti POMA in 53 older adults were 14, 68%, and 78% (21). Fabeet al. reported that the cut-off value, sensitivity, and specificity of the Tinetti POMA in older adults with a mean age of 84.9 years were 19, 64.0%, and 66.1% (22).

In our study, the clinical cut-off point for the POMA was determined as 15.5 points in older adults with mild cognitive impairment (sensitivity=31.90%, specificity=88.66%, Area under the Curve (AUC) =0.651). A cut-off score of 15.5, which indicates adults whose MMT ≥24, was used to assess POMA sensitivity and specificity. Fall risks of adults with mild cognitive impairmentwere correctly predicted by an admission POMA of ≤15.5 (31,90% sensitivity). However, only 88.66% (specificity) of health score was >15.5. Of the 97 participants whose score was >15.5, 52.12% (negative predictability) were healthy in the study. However, only 77.08% (positive predictability) of those who scored ≤15.5 had mild cognitive impairment. The POMA appeared to have a high discriminatory power for older adults with cognitive impairment. The cut-off values of the POMA in older adults with a history of falling and the cut-off values of the POMA in older adults with cognitive impairment are similar to each other.

There is limited information about which risk behaviours affect falling in older adults or about how to measure them (23). Cognitive impairment in the older adults are an important factor that increases the risk of falling (24,25). Approaches aimed at preventing falls in older adults with cognitive impairment have not been yet clearly

ascertained (24). There are many scales available in the clinic for determining the risk of falling in older adults (26). There are studies that give cut-off values of these scales. Gettens and Fulbrook determined that the cut-off value, sensitivity, and specificity of the Modified Falls Efficacy Scale in older adults with a history of falling were 5.77%, and 55%, respectively (27). Rapport et al. found that the cut-off value, sensitivity, and specificity of the Fall Assessment Questionnaire were 3, 73%, and 88%, respectively (28). Schmidet al. found that the cut-off value, sensitivity, and specificity of the Fall Risk Assessment Questionnaire were 3, 93%, and 78%, respectively (29). Hendrichet al. determined that the cut-off value, sensitivity, and specificity of the Hendrich Fall Risk Model were 3, 77%, and 72%, respectively (30). Macavoyet al. reported that the cut-off value, sensitivity, and specificity of the Fall Risk Assessment Questionnaire were 10, 43%, and 70%, respectively (31). Morse et al. determined that the cut-off value, sensitivity, and specificity of the Morse Fall Scale were 45, 78%, and 83%, respectively (32).

The 13-item FRQ that indicates the risk of falling is an evidence-based, clinically appropriate, and validated scale beyond current assessments. In addition, the FRQ is a scale that has the ability to sensitively identify older adults at risk of falling. Rubenstein et al. determined that the cut-off value, sensitivity, and specificity of the FRQ in 40 older adults were 4, 100.0%, and 83.3%, respectively. 16 In our study, the clinical cut-off point for the FRQ was determined as 4.5 points in older adults with mild cognitive impairment (sensitivity=56.03%, specificity=74.23%). A cut-off score of 4.5, which indicates 'healthy adult', was used to assess FRQ sensitivity and specificity. Fall risks of adults with mild cognitive impairment were correctly predicted by an admission FRQ of >4.5 (56.03% sensitivity). However, only 74.23% (specificity) of health score≤4.5. Of the 97 participants whose score was ≤4.5, 58.54% (negative predictability) were healthyinthe study. However, only 72.22% (positive predictability) of those who scored >4.5 had mild cognitive impairment. The FRQ appeared to have a high discriminatory power for older adults with cognitive impairment (Area Under the Curve (AUC) =0.712).

CONCLUSION

We think that it is important to take these values into account in interpreting these commonly used tests when cognitive status is considered related to falling.Therefore,it is suggested that these tests used in the clinic should be examined considering the risk of falling in older adults with mild cognitive functions.It is also important to take individual and environmental measures into consideration to reduce the risk of falls in older adults.

The studies in the literature give cut-off values of the POMA and FRQ scales used in healthy, falling, or non-falling older adults. This study is important for older adults with mild cognitive impairment. We think that cut-off values of these two important scales, which are frequently used in the assessment of balance and falling in older adults, should be determined in future studies for individuals with moderate and severe cognitive impairment.

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