ORIGINAL ARTICLE

Dementia staging and the correlation with the functional performance of the elderly with Alzheimer's disease: a cross-sectional study

Estadiamento demencial e a correlação com o desempenho funcional de idosos com doença de Alzheimer: um estudo transversal

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ABSTRACT

Objective: To evaluate dementia staging, physical-functional performance, and their possible correlations of elderlies with Alzheimer's Disease, assisted by a referral center. **Method:** Quantitative cross-sectional study of elderlies of both sexes, aged 60 years or older, with a clinical diagnosis of Alzheimer's Disease. The participants were evaluated with the Timed Up and Go Test (TUG), Rikli & Jones Sit and stand Test, Berg Balance Scale, and the Clinical Dementia Rating Score (CDR). Statistical analysis classified and compared groups of frail and non-frail participants with unpaired tests. The significance level was 0.05. **Results:** 46 participants of both sexes with a mean age of 78.72±7.37 years. Subjects were divided into frail and non-frail elderly. Older people were classified into questionable to mild dementia and moderate to severe dementia and matched. There was a significant correlation between age and TUG (r= 0.532; p= 0.041), age and Berg (r= -0.343; p= 0.040), TUG and Berg (r= -0.562; p= 0.029), and sit-stand test and Berg (r= 0.706; p= 0.003). **Conclusion:** Lower performance compared to the specialized literature for the assessment instruments proposed in this research was found, indicating that AD progression was directly related to their performance in physical-functional tests.

Keywords: Alzheimer Disease, Physical Functional Performance, Physical Therapy, Aged

RESUMO

Objetivo: Avaliar o estadiamento demencial e o desempenho físico-funcional, bem como suas possíveis correlações, de idosos diagnosticados com Doença de Alzheimer, atendidos por um centro de referência. **Método:** Estudo clínico transversal de abordagem quantitativa. Foram avaliados idosos de ambos os sexos com idade igual e/ou superior a 60 anos, que tivessem o diagnóstico médico comprovado para Doença de Alzheimer. Os idosos foram avaliados por meio do Timed Up and Go Test (TUG), Teste de Sentar e Levantar de Rikli & Jones, Escala de Equilíbrio de Berg e por meio do Clinical Dementia Rating Score (CDR). A análise estatística e os gráficos foram realizados com o Software IBM Statistics SPSS 20. O nível significância foi 0,05. **Resultados:** Compuseram a amostra 46 indivíduos de ambos os sexos com idade média de 78,72±7,37 anos. Os indivíduos foram divididos em idosos frágeis e não frágeis. Os idosos também foram classificados em demência questionável a leve e demência moderada a grave e comparados. Ocorreu correlação significativa entre idade e TUG (r= 0,532; p= 0,041), entre idade e Berg (r= -0,343; p= 0,040), entre TUG e Berg (r= -0,562; p= 0,029), e entre o teste de sentar-levantar e Berg (r= 0,706; p= 0,003). **Conclusão:** Os idosos avaliados apresentaram desempenho inferior aos descritos na literatura para os instrumentos avaliativos propostos nessa pesquisa, o que indica que está diretamente relacionado ao seu desempenho em testes físico-funcionais.

Palavras-chaves: Doença de Alzheimer, Desempenho Físico Funcional, Fisioterapia, Idoso

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INTRODUCTION

Aging is currently and widely understood as a time-dependent process of physical, cognitive, and mental changes. It demands specialized attention since there is a worldwide growing elderly population.[1]

Aging is a natural process in which the body undergoes physiological changes. When aging is physiological, senescence biological changes are initiated. However, when it is pathological, diseases may be onset due to the accumulation of damage caused by the interaction between genetic factors and unhealthy habits. Such habits include an unbalanced diet, smoking, alcoholism, and a sedentary lifestyle.[2]

In Brazil, a current public health concern is the increase in the elderly population. In this context, healthcare professionals are discussing interventions to improve Brazilians' quality of life. It is known that people aging 60 years or above are prone to develop numerous chronic pathologies, including Alzheimer's Disease (AD).[3]

AD can be defined as an irreversible brain disorder that progressively damages brain neurons. It is characterized by general cognitive and memory deficits and behavioral symptoms such as depression, anxiety, and apathy. Also, patients with AD eventually experience limitations in their daily activities until they completely cease performing them, further deteriorating their quality of life.[4]

The performance of activities of daily living (ADLs) is impaired in older adults with Alzheimer's Disease, which can be combined with other components related to functional capacities, such as flexibility, resistance, strength, balance, rhythm, motor coordination, agility, and speed. These factors may be directly associated with the increased risk of falls among elderlies with AD.[5] Moreover, the prevention or treatment of muscle strength decline can also be an effective way to reduce the number of falls and promote healthy aging of the elderlies.[6]

Therefore, socioeconomic planning and scientific research should be motivated to provide quality of life and cost reduction with the health system, especially for providing tools for early diagnosis, prevention, and treatment.[7]

Significant correlations between dementia levels and activities of daily living impairments are commonly found, and even in the early stages of the disease, the performance during these activities is compromised. As part of the clinical evaluation of patients with dementia, it is necessary to assess the ability of these patients to carry on with their daily activities.[8]

Therefore, the cognitive and functional deficits of AD progression are important issues because, as they are strongly associated with ADLs, their impairment may imply a reduction in autonomy, followed by a greater risk of hospitalization, depression, decreased level of physical activity, and even death.[9]

In this context, assessing the functionality of patients with AD is essential for developing therapeutic approaches that minimize functional loss.[10]

OBJECTIVE

Considering this context, our study aims to assess and correlate the dementia staging and the physical-functional performance of patients with Alzheimer's disease admitted to a reference clinic.

METHODS

The Independent Ethics Committee approved this research of the Universidade Estadual do Centro-Oeste (UNICENTRO) (approval number 3,363,878 / June 3, 2019).

The study design is quantitative and cross-sectional and was conducted according to resolution 466/2012 of the Brazilian National Health Council/CNS. The study was organized according to the following sequence: theme and target audience definition; determination of eligibility criteria; sampling; Informed Consent Form signing; data collections; writing results; data discussion, final manuscript writing, and corrections; article submission.

The patients and their caregivers were verbally invited to participate in the study during a routine medical follow-up visit. In this first contact, the volunteers were informed about the risks and benefits of their voluntary participation and that they would be assisted throughout the evaluations by the responsible researchers. All patients of the Institution were listed as possible study participants. Those who met the eligibility criteria and consented to participate in the study signed the Informed Consent Form (ICF). The caregivers were present throughout the evaluations. This method is substantial since many participants have severe dementia, according to the Clinical Dementia Rating Score questionnaire (CDR).

The included patients were elderly of both sexes aged 60 years or above, with a clinical diagnosis of Alzheimer's Disease and the presence of a caregiver during the presentation and signing of the Informed Consent Form (ICF).

Patients under the age of 60, without a confirmed diagnosis of Alzheimer's Disease, who did not agree to their participation in the study, or whose caregivers disapproved of their participation, were not included in the study.

The assessments were conducted at the participant's home since the Institution has multi-interdisciplinary home care teams. A social worker of the institution was present during all assessments.

As it was the first contact between the physical therapists and the patients, the evaluations were divided into two moments: I- initial anamnesis for data collection and presentation of patient's history and clinical evolution; II- application of validated assessments regarding the health-disease, kinetic-functional and cognitive impairments status of the participant. This information could be used to map and identify the most vulnerable patients and provide them with proper assistance according to their needs. The tests, questionnaires, and scales applied to the patients are essential and common in clinical practice.

TUG Test

The "Timed Up and Go" (TUG) is a straightforward reproducible,[11] cost-effectiveness test that analyzes mobility and functional balance, especially among older adults, being capable of assessing the risk of falls, fear of falling, and functionality.[12] This assessment was initially described by

Podsiadlo and Richardson[13] and consisted of getting up from an armless chair, walking a distance of 3 meters ahead, turning around, walking back, and sitting in the chair again. Subjects who perform this activity between 10 and 20 seconds are generally independent, and if there is no history of falls or atypical gait pattern, no further action is needed, whereas 20 seconds or more indicates postural instability and a high risk of falls. This test protocol assesses the physiological capabilities to perform routine daily activities independently and safely.[14]

Rikli & Jones 30 seconds Sit and Stand Test

Physical exercise, especially for the elderly, is crucial in delaying the functionality decline.[15,16] Among the various activities and functional tests standardized by Rikli and Jones,[17] the Sit and Stand Test aims to record the lower limb strength, which is a predictor of the risk of falling in the elderly. The test counted the number of complete repetitions of standing and sitting on a chair for 30 seconds.[17]

The chair seat was approximately 43cm in height, and the individuals were requested to perform this test with their arms crossed over the chest.[7] At the "start" signal, the participant stood up until maximum extension (vertical position) and returned to the initial sitting position, laying the trunk onto the chair splat. The first three sit to stand movements were considered as the assessment instructions, and lastly the patient was requested to repeat the movement of stand and sit as many times as they could for 30, and the number of repetitions were retrieved as the assessment outcome.

Berg Balance Scale

The Berg Balance Scale is a validated assessment for functional balance. In addition to being low cost, it is easy to handle and safe for elderly patients. This scale is also widely used in clinical practice and research, as it assesses the risk of falls. It was adapted for the Brazilian population by Miyamoto et al.[18] and it includes 14 5-item tasks. The score ranges from 0 to56 points, with a cut-off point of 45 points to the risk of falling.[19]

The 14 items are divided into subscales of 5 in ordinal categorical alternatives, ranging from 0 to 4 points, with 0 being the moderate or maximum need to perform the activity and four the ability to perform the task without assistance. The maximum score is 56 points, varying according to the activity time and assistance during execution, and lower scores indicate a greater risk for falls.

Clinical Dementia Rating Score (CDR)

The Clinical Dementia Rating Score (CDR) was developed to rate dementias, especially Alzheimer's Disease (AD). It is divided into memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. For each of these domains, the elderly are classified according to pre-established criteria as CDR0 (questionable dementia), CDR1 (mild dementia), CDR2 (moderate dementia), and CDR3 (severe dementia).[20] The CDR Questionnaire is an instrument capable of grading the staging of dementia in AD.[21]

Statistical Analysis

The Statistical analysis and graphics were performed using IBM Statistics SPSS® 20. Data are described as frequencies, percentages, means and standard deviations. Normality was tested with the Shapiro-Wilk test and the homogeneity of variances with the Levene test. For the comparison of numerical variables, unpaired Student t-tests were used for parametric variables and the Mann-Whitney test for non-parametric variables. In the correlations, Pearson's or Spearman's correlations were used according to data distribution. The significance level was 0.05.

RESULTS

The study sample comprised 46 individuals of both sexes with a mean age of 78.72±7.37 years, and females corresponded for 73.91% of the patients (n= 34). The mean body mass index (BMI) was 26.67±6.68 kg/m2, 13% were underweight, and 28.3% were obese (Table 1). The mean abdominal perimeter was 99.53±15.74cm.

Regarding locomotion, eleven participants were confined to bed (23.9%), 36 could be assessed by the Berg Balance Scale, and only 15 could perform the sit and stand and the Timed Up and Go Test independently or with minimal supervision from the evaluators. Regarding comorbidities, Systemic Arterial Hypertension was present in 54.3% of the participants, followed by Depression in 23.9% (Table 1).

Subjects were divided into frail and non-frail elderly. There was no difference in age, BMI, or time of the Timed Up and Go Test (TUG) among those who managed to perform this test ($p>0.05$) (Table 2).

The elderly who performed the Sit and Stand Test and the Berg Balance Scale showed significant differences in the results between the non-frail and the frail ($p\leq0.05$). The frail elderly had fewer sitting and standing repetitions and a lower score, suggesting balance issues compared to the non-frail (Table 2).

Older people were classified into questionable to mild dementia, moderate to severe dementia, or a combination. There were no differences regarding age, BMI, and time of the TUG Test ($p>0.05$). In the Sit and Stand Test and Berg Balance Scale, the elderly classified as having moderate to severe dementia had fewer repetitions in sitting and standing and a lower balance score ($p\leq0.05$) (Table 2).

There was a significant correlation between age and TUG ($r= 0.532$; $p= 0.041$), age and BBS ($r= -0.343$; $p= 0.040$), TUG and BBS ($r= -0.562$; $p= 0.029$), and sit and stand test and BBS ($r= 0.706$; $p= 0.003$).

These results indicate that the greater the age, the lower the functionality (Figures 1A and 1B). Associations of longer TUG time, fewer repetitions in the sit and stand test, and lower balance scores are shown (Figures 1C and 1D).

DISCUSSION

The present research aimed to identify the physical-functional profile and the dementia staging of older adults with Alzheimer's Disease. Our results allowed us to observe a predominance of the elderly with associated comorbidities and some degree of functional dependence.

Table 1. Sample characteristics and variable distributions

	Mean ± SD	Minimum - Maximum		
Age (n= 46)	78.72 ± 7.37	63 – 91		
BMI (n= 46)	26.67 ± 6.68	13.33 – 44.98		
Abdominal circumference (n= 46)	99.53 ± 15.74	58 – 129		
TUG (n= 15)	33.43 ± 39.47	2 – 154		
Sit and stand test (n= 15)	3.33 ± 1.23	2 – 6		
Berg (n= 36)	38.81 ± 17.30	55 – 33.81		
BMI n (%)	Underweight	Normal weight	Overweight	Obese
	6 (13%)	17 (37%)	10 (21.7%)	13 (28.3%)
Treatments	Pharmacological	Pharmacological and medical	Pharmacological, medical, and physiotherapeutic	
	14 (30.4%)	31 (67.4%)	1 (2.2%)	
Functionality	Independent	Partially dependent	Fully dependent	
	13 (28.3%)	21 (45.7%)	12 (26.1%)	
Cognition / Dementia	Questionable	Mild	Moderate	Severe
	8 (17.4%)	6 (13%)	8 (17.4%)	24 (52.2%)
HAS	Yes	No	Not informed	
	25 (54.3%)	21 (45.7%)	-	
Diabetes Mellitus	9 (19.6%)	37 (80.4%)	-	
Depression	11 (23.9%)	33 (71.7%)	2 (4.3%)	
Anxiety	8 (17.4%)	36 (78.3%)	2 (4.3%)	
Thyroid dysfunction	3 (6.5%)	41 (89.1%)	2 (4.3%)	
Parkinson's Disease	3 (6.5%)	42 (91.3%)	1 (2.2%)	
Stroke	4 (8.7%)	41 (89.1%)	1 (2.2%)	
Osteoporosis / Osteoarthritis	5 (10.9%)	41 (89.1%)	-	
Confined to bed	11 (23.9%)	35 (76.1%)	-	
Frail	23 (50%)	23 (50%)	-	

SD- Standard Deviation; BMI- Body Mass Index; TUG- Timed up and go test; BBS- Berg Balance Scale; SAH- Systemic Arterial Hypertension

Table 2. Frailty and dementia subgroups comparison

	Frailty		
	Yes (n= 23)	No (n= 23)	*p-value*
Age (years)	80.57 ± 8.03	76.87 ± 6.28	0.089
BMI (kg/m^2)	25.11 ± 7.24	28.22 ± 5.80	0.09
TUG[a] (seconds)	(n= 6)	(n= 9)	
	45.76 ± 55.20	25.22 ± 25.14	0.316
Sit and stand test[a] (repetitions)	2.5 ± 0.54	3.89 ± 1.26	0.027*
Berg[a] (score)	(n= 13)	(n= 23)	
	18.67 ± 14.66	43.56 ± 9.65	<0.001*
	Dementia		
	Questionable to mild (n= 14)	Moderate to severe (n= 32)	*p-value*
Age (years)	76.79 ± 5.42	79.56 ± 8.08	0.179
BMI (kg/m^2)	28.48 ± 4.34	25,87 ± 7.40	0.145
TUG[a] (seconds)	(n= 7)	(n= 8)	
	21.21 ± 13.37	44.13 ± 51.79	0.471
Sit and stand test[a] (repetitions)	4.14 ± 1.21	2.63 ± 0.74	0.016*
Berg[a] (score)	(n= 14)	(n= 22)	
	43.86 ± 9.82	24.63 ± 17.28	0.011*

** p≤ 0,05; [a] Mann-Whitney test; BMI- Body Mass Index; TUG- Timed Up and Go Test; BBS- Berg Balance Scale*

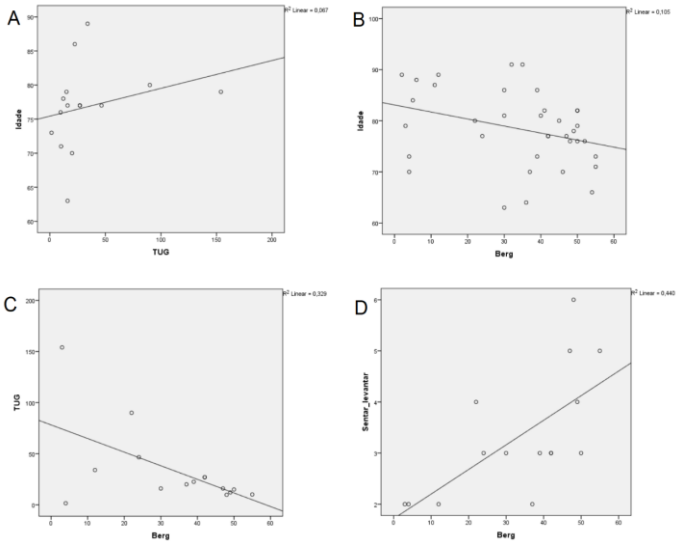

Figure 1. A, correlation between age (Years) and TUG (seconds); B, the correlation between age (years) and Berg Balance Scale (score); C, the correlation between TUG and Berg Balance Scale (score); D, the correlation between sit and stand test (repetitions) and Berg Balance Scale (score)

Also, the participants could be classified as frail and not frail based on the results, and the analysis demonstrated correlations between frailty and other variables.

In the study sample, there was greater participation of females (73.91%), and their age ranged from 63 to 91 years old, agreeing with other authors, who describe a higher incidence of Alzheimer's disease among women aged 65 years and above.[6] The highest number of diagnoses of Alzheimer's Disease, as well as other diseases, is higher among female individuals could be due to a cultural issue, as women use the public system earlier and adhere to treatments more frequently when compared to men.

Other authors have described essential variables related to the functional performance of the elderly, including the presence of one or more comorbidities or chronic diseases.[22] Among our study participants, Systemic Arterial Hypertension and Diabetes Mellitus were the comorbidities with the highest incidence (54.34% and 8.33%, respectively), which is concordant with the specialized literature.

Another critical aspect to consider is that the decline in cognitive functions presented by the elderly with AD generates the disorganization of locomotion control, leading to a series of changes in gait performance, including the planning, control, and execution of movements. Although previous studies have shown that physical function is impaired in AD, the impact of cognitive decline on the neuromuscular system has not yet received much scientific attention and needs further investigation.

Previous authors investigated the cognition and motor skills of individuals with Alzheimer's Disease. One publication reported assessments of 10 women with a mean age of 78.8 years, and, based on their level of education, they had an intermediate classification in their state of cognitive impairment. Considering functional performance, 60% of the sample presented results within the expected.[23] Although different evaluative instruments were used in our research, it is also possible to observe that the moderate to severe dementia state directly influenced the impairment in functional performance tests.

According to the literature, functional capacity is one of the main components of elderly-related health. More recently, this issue has emerged as a fundamental component in the assessment of the health of this population, especially regarding individuals with disabling diseases such as Alzheimer's Disease.[24]

Some authors evaluated the functional capacity, mobility, and balance of the elderly with Alzheimer's Disease (AD).[25] Their participants were evaluated with the Clinical Assessment Questionnaire of Dementia Status (CDR) and the Timed Up and Go. In this publication, it was possible to observe that the elderly with AD have decreased functional capacity, mobility, and risk of falls associated with the disease progression. The findings of our study corroborate with those described by these authors, as the progression of the disease and the patient's age are significantly correlated with lower performance in functional tasks.

A literature review study emphasized the effects of physical exercise on the cognitive and motor domains of elderlies with Alzheimer's disease.[26] The authors concluded that individuals undertaking intervention programs obtained better results in different clinical assessments that predict functional capacity when compared to individuals who did not participate in physical activities.

Another study evaluated the mobility, functionality, and balance of individuals with Alzheimer's disease.[26] On average, the participants performed the Timed Up and Go in 24.2 seconds and obtained 39 points on the Berg Balance Scale. Comparing these results with the values predicted in the literature, we observed that these individuals performed worse than expected, a finding that was also verified among our research participants.

As described in other studies, it is substantial to implement more effective and prophylactic interventions to contain the functional losses related to the progress of Alzheimer's Disease.[26]

The main limitations of the present research are the adherence of participants to submit to these and other assessment instruments since data collection was conducted during the COVID-19 pandemic period. Based on this research, it is expected to continue the prevention, promotion, and rehabilitation programs, contributing to the functional independence and autonomy of patients with AD and promoting the dissemination of knowledge on this issue.

CONCLUSION

According to the assessments of this research, patients with AD showed lower performance than those described in the literature, indicating that the volunteers are at high risk for falls and that cognitive impairment is directly related to their performance in physical-functional tests. Further studies on this matter should be conducted.

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