Evaluation of the functional capacity of patients with chronic kidney disease using the ADL-Glittre test

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Abstract

Chronic diseases are becoming a serious public health problem, including chronic kidney failure (CKF), which causes significant functional losses, limitation of activities of daily living (ADL) and impairments in quality of life. As a result, the application of instruments that assess functional capacity in clinical practices becomes relevant. Thus, the objective of the present study was to evaluate the functional capacity of patients with CKF by the ADL-Glittre test. This was a cross-sectional study, including 31 male and female volunteers, divided into two groups: CKD-G (n=19) and CG (n=12), respectively. For the statistical analysis comparing categorical variables, the chi-squared test was used, and for the continuous variables the Mann-Whitney test, with a statistical significance level of 5%. There was a significant difference between the studied groups regarding the time taken to perform the ADL-Glittre [CKD-G: 3.1 (0.5) minutes and CG: 2.5 (0.2) minutes (p=0.001)] and in the ADL-Glittre reports [normal or reduced: CKD-G (0/19) and CG (6/6) (p=0.001)]. In both variables, the CKD-G obtained lower results. In conclusion, it was observed that CKD resulted in impairment of functional capacity and that the ADL-Glittre Test proved to be an appropriate instrument for the assessment of functional capacity of CKD patients.

Keywords: Chronic Kidney Failure; Daily activities; Functional Physical Performance.

INTRODUCTION

Chronic diseases are becoming a serious public health problem worldwide, as they are constantly increasing, and this fact is due to the various epidemiological changes that societies have gone through; especially the increase in life expectancy. Diseases such as diabetes, hypertension and chronic kidney disease (CKD) cause various impacts and limitations on functional capacity, activities of daily living (ADL), leisure time and social and cultural life, as well as being an important risk factor for morbidity and mortality[1-6].

CKF is a characteristic, progressive, chronic and irreversible disease of kidney function (glomerular, tubular and endocrine)[5,7,8]. CKF causes structural and functional changes in

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the kidneys and consequently affects other organs and body systems, contributing to reduced physical capacity, limitations in activities of daily living (ADL) and a worsened quality of life[8,9]. The prognosis of patients with CKF is as follows: decreased cardiorespiratory conditioning, musculoskeletal disorders, reduced physical capacity and impaired quality of life[10,11].

Thus, there is a growing investigation for appropriate physical and functional assessment instruments that support the practice of physical therapy[12,13]. The ability to perform ADLs can be assessed by: direct observation, which is performed by observing the subjects or through video recordings during daily tasks; applying questionnaires or scales which are cheaper, easy to apply methods; or by applying submaximal functional tests such as the 6-minute Walk Test (SMWT), the Shuttle Walk Test (SWT)[14], or the ADL-Glittre test.

The purpose of functional tests is to represent the most accurate ADL in order to improve assessment and make it more reliable in the clinical setting. However, some tests such as the SMWT and SWT do not portray both ADL and ADL-Glittre; which, in addition to simulating walking activities, also include climbing and descending steps, sitting and lifting, trunk and upper limb movements with weight. These advantages make ADL-Glittre an evaluation tool with excellent prospects for clinical viability for individuals with CKF[15].

Since it is clear that CKD results in changes in body structure and function that compromise mobility and the performance of basic daily tasks, several studies with chronic kidney patients have been guided by the perspective of functionality[12].

In this sense, the investigation for adequate physical and functional assessment instruments that support the practice of physical therapy in the field of health promotion, prevention and rehabilitation of chronic kidney patients is growing[12,8]. Therefore, this study aimed to evaluate the functional capacity of patients with CKF undergoing hemodialysis, using the ADL-Glittre test. Patients with CKF are hypothesized to have reduced functional capacity.

METHODOLOGY

This was an observational, cross-sectional and non-probability convenience study conducted from July 2017 to April 2018. It was developed at the Integrated School Clinic (CEI/INISA) of the Federal University of Mato Grosso do Sul (UFMS) and at the SIN Kidney Therapy Clinic - Campo Grande, MS, after approval by the Research Ethics Committee of the Federal University of Mato Grosso do Sul (Opinion No. 2.102.764). Participants were approached at the SIN Clinic and invited to participate in the study after the presentation of the objectives, methodology and test application. Subsequently, the Informed Consent Form (ICF) was made available for reading and signing in accordance with National Health Council Resolution 466/12.

The study included individuals of both sexes, divided into two groups: Chronic kidney disease group (CKD-G): 19 patients with chronic kidney disease undergoing hemodialysis (15 men and 4 women), and Control group (CG): 12 healthy individuals (9 men and 3 women), matched for age, sex, and anthropometric characteristics. CKD-G participants were recruited from the SIN Kidney Therapy Clinic, while those from the CG were recruited from UFMS and the community.

Individuals of both sexes, over 18 years of age and who had medical clearance to perform efforts were included in the CG. To compose the CKD-G, a medical diagnosis of chronic kidney disease and uninterrupted dialysis treatment were required. Exclusion criteria for both groups were: presence of cognitive impairment, presence of diseases and/or cardiac arrhythmias that contraindicated physical exertion, presence of dyspnea at rest, presence of pulmonary diseases, presence of limitations that interfered with the ability to move, and presence of other clinical conditions that may be exacerbated by physical exertion.

For both groups, an individual anamnesis was performed containing personal and sociodemographic information, physical

examination, family history of diseases, medications used and main complementary exams. Then both groups were submitted to anthropometric and functional capacity assessments (ADL-Glittre Test).

Anthropometric assessment

Height was measured using a simple tape measure and body weight with portable scale (G-tech). Body Mass Index (BMI) was calculated by the formula: body mass/height x height (kg/m^2). The BMI classifications adopted in this study were: low weight (<18.5 kg/m^2); eutrophic (18.5-24.9 kg/m^2); pre-obese (25.0 to 29.9 kg/m2); obese I (30.0 to 34.9 kg/m^2); obese II (35.0 to 39.9 kg/m^2); obese III (≥40.0 kg/m^2)16.

ADL-Glittre Test

To assess the functional capacity of individuals, the ADL-Glittre test[15] was performed. It is an instrument developed and validated primarily to assess the functional capacity of patients with chronic obstructive pulmonary disease (COPD). It consists of carrying a backpack with a weight of 2.5 kg for women and 5 kg for men, covering a circuit with the following activities: from the sitting position, the individual walks on a flat 10-meter long course, interupted halfway (5 meters) by a box with two steps for climbing and two for descending (17 cm high x 27 cm wide). After traveling the rest of the way, the individual is faced with a bookcase containing three objects of 1 kg each, positioned on the highest shelf (shoulder height of the participant) and then moving them one by one to the lowest shelf (close to the participant's waist height) and then to the floor. The objects should then be relocated to the lowest shelf and later to the highest shelf. The individual then returns, taking the same route; they then immediately restart another lap, traveling the same circuit[15]. It was advised that they should do five laps in the shortest possible time. Heart rate (HR), peripheral oxygen saturation (SpO_2) and dyspnea index (assessed by the modified Borg effort perception scale)[17] were measured at the beginning, each lap and at the end of the test[15]. Respiratory rate, systolic blood pressure and diastolic blood pressure were also checked before and after the test.

Statistical analysis

Data were analyzed using the SPSS (Statistical Package for Social Science) software for Windows (version 13.0). The chi-squared test was used to evaluate the association of categorical variables, and the Mann-Whitney test for comparison of continuous variables. In all tests the level of statistical significance of 5% was considered.

RESULTS

The characterization of the sample, shown in Table 1, demonstrates that the groups were homogeneous in terms of gender, age and anthropometric characteristics. Males and eutrophic patients predominated in both groups, according to the BMI values.

Table 1– Characterization of the sample, Campo Grande- MS, 2018.

Variables	CKD-G (n=19)	GC (n=12)	P-value
Sex*	n (%)	n (%)	
Female (n = 7)	4 (21.06%)	3 (25%)	
Male (n = 24)	15 (78.94%)	9 (75%)	0.798
Age#	50.5 (9.3)	39.3 (10.2)	
Body mass index	25.5 (4.5)	26.3 (4.0)	0.584

*Data presented in absolute frequency and relative frequency.
#Data presented in median and interquartile range.
Chi-square test p value for Sex variable
Mann Whitney test p-value for the variables Age and BMI.
Caption: CKD-G: chronic kidney disease group; CG: control group.

Table 2 shows the results regarding the etiology of chronic kidney disease, glomerular filtration rate, disease stage and CKD-G comorbidities. Regarding the etiology of chronic kidney disease, there was predominately hypertensive nephrosclerosis. Among the comorbidities found, systemic arterial hypertension (SAH) was the most reported.

Table 2– Etiology, glomerular filtration rate and comorbidities of CKD-G, Campo Grande - MS, 2018. (n = 19).

Variables	n (%)
Cause Of Kidney Disease	
Hypertensive nephrosclerosis	13 (68.42%)
Kidney Agenesis	1 (5.26%)
Chronic Glomerulonephritis	2 (10.52%)
Sepsis	1 (5.26%)
Diabetic nephropathy	2 (10.52%)
Glomerular Filtration Rate (ml / min / 1.73m²)	
Stage 4 (15 - 29)	9 (47.36%)
Stage 5 (<15)	10 (52.63%)
Comorbidities *	
Systemic Arterial Hypertension	17 (89.47%)
Diabetes	7 (36.84%)
Hyperparathyroidism	1 (5.26%)
None	1 (5.26%)

Data presented in absolute frequency and relative frequency.
*Each volunteer could indicate one or more comorbidity.

The results regarding the functional capacity outcome are described in Table 3. It can be observed that there was a significant difference between the groups in relation to the ADL-Glittre report (normal x reduced) and in the analysis of the time taken to perform it; in both, the CKD-G had a greater impairment.

Table 3– ADL-Glittre Test Result according to groups, Campo Grande - MS, 2018.

ADL-Glittre Test	CKD-G (n=19)	CG (n=12)	P-value
Results	n (%)	n (%)	
Normal	0 (0%)	6 (50%)	0.001
Reduced	19 (100%)	6 (50%)	
Variables			
Total Time (min)	3.1 (0.5) #	2.5 (0.2) #	0.001
Maximum Heart Rate (bpm)	114.1 (17.2) #	108.0 (23.5) #	0.543
Max. Borg score	4.3 (3.1) #	4.3 (2.4) #	0.984

*Data presented in absolute frequency and relative frequency.
#Data presented in median and interquartile range.

DISCUSSION

In this study, the group of chronic kidney patients was predominantly male, corroborating data from the Brazilian Dialysis Census 2011[18]. According to the Brazilian Society of Nephrology (SBN)[18], about 57% of patients with CKD were male, that is, the majority[10,19-21].

Comprising an age group between 19 and 64 years, the CKD-G median was 50.5 (9.3) years of age, which coincides with the findings of SBN18. In contrast, Gravina *et al.*[22] and Abreu *et al.*[10] observed in their studies that individuals were over 65 years old. Moreover, Marinho *et al.*[1] emphasized that those most affected by chronic kidney diseases are adults between 20 and 65 years old.

Regarding anthropometric characteristics, the CKD-G was predominantly eutrophic, which coincides with Gravina *et al.*[22]. This was unlike the findings of Biavo *et al.*[23], who, when evaluating elderly individuals from northeastern Brazil, observed predominantly low weight, and which was also found by Lenardt *et al.*[24] when studying long-lived elderly patients.

Regarding the etiology of CKD of CKD-G studied, hypertension was predominant, followed by hypertensive nephrosclerosis and diabetes mellitus. These findings agree with other studies which showed that their patients had hypertension and diabetes mellitus as their underlying disease[10,19-22].

Corroborating the findings of this study, previous studies[25-27] found that dialysis patients had reduced gait speed compared to non-patients. Walking is an activity that integrates various body systems and gait speed can provide many indications of the health of the dialysis patient from a broader perspective[28].

Additionally, other authors[10,22,28,29] reported that patients with chronic kidney disease had a significant reduction in the distance covered compared to the predicted distance in the 6-Minute Walking Test. Both speed and functional performance of dialysis patients were lower compared to healthy patients. This fact demonstrates the impacts caused by the disease which impair the cardiorespiratory, circulatory, immune, endocrine/metabolic, nervous and musculoskeletal systems[28].

It is noteworthy that changes in various body systems are associated with advanced stages of CKD and that patients with CKD, especially those undergoing hemodialysis (HD), have significant musculoskeletal complications. In this study, all members of CKD-G had reduced functionality in the ADL-Glittre Test.

Frazão *et al.*[30] agreed that the musculoskeletal system is negatively influenced by CKF. Some causes are changes in muscle perfusion, imbalance between anabolism and catabolism, presence of metabolic acidosis, corticosteroids and proinflammatory cytokines, which all lead to poor performance in physical activities[30]. A vicious cycle is observed, in which the deterioration of the musculoskeletal system leads to a lower tolerance for physical effort, which consequently brings with it reduced cardiorespiratory capacity, persistent fatigue, and resulting in physical disability and important functional limitations[15,22,29,31].

It can be observed in the literature, the existence of other studies that used the ADL-Glittre in different population groups in order to evaluate the functional capacity in different health conditions. The test has been used in healthy adults[32], hospitalized adults with acute lung disease[33], obese patients and those in the postoperative period of bariatric surgery[34], in individuals with cardiovascular disease[35], in patients with bronchiectasis[36], in patients after stroke[37], in Parkinson's patients[38] and it has already been adapted for children[39].

The use of ADL-Glittre is widespread in several studies. The results have been satisfactory in all the aforementioned studies, especially regarding the ease in comprehending and executing the test by the patients and the evaluators.

CONCLUSION

CKF resulted in impaired functional capacity and the ADL-Glittre proved to be a good alternative for measuring the functional capacity of chronic kidney patients undergoing dialysis.

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