

18 - CORRELATION BETWEEN THE TIME OF STAY IN HEMODIALYSIS AND EXERCISE CAPACITYCELEIDE PINTO AGUIAR PERES;
JACQUELINE COUTINHO

Universidade Estadual do Oeste do Paraná – UNIOESTE - PR

INTRODUCTION

Chronic kidney disease (CKD) can be considered a public health problem with the overall increase in its prevalence and incidence, becoming an "epidemic" of growth rate. According to the Brazilian Society of Nephrology (2007), it is estimated that more than two million people have some degree of renal dysfunction increasing the risk of premature death from cardiovascular disease. Uremic patients undergoing hemodialysis (HD) commonly have low functional ability, related to various factors and symptoms, among them anemia, neuropathy, uremic myopathy, hypertension, cardiomyopathy, nutritional disorders, metabolic, cardiovascular, respiratory, musculoskeletal, immunological and psychological disorders. All these factors can exacerbate the physical weakness of these patients (and MOREIRA BARROS, 1998; Kouider, 2001). Painter et al. (2006) consider physical inactivity an additional factor associated with reduced exercise capacity. There are many limitations of chronic renal failure in cardiovascular function and aerobic capacity, resulting in reduced muscle performance and a consequent decrease in exercise tolerance with impaired quality of life, however, its causes are not yet fully evident. The objective of this study was to correlate exercise capacity with time spent in hemodialysis patients with chronic renal failure, providing scientific information to professionals in this specialty, to establish better criteria for evaluation and rehabilitation for this population. Chronic kidney disease has been currently considered a major public health problem not only related to the great increase in the number of patients, but also by increasing the speed of progression to the final stage of the disease. Epidemiological surveys suggest there are approximately one million people with chronic kidney disease around the world, and possibly the global epidemic of the significant increase of cases of diabetes mellitus and the increasing life expectancy of the world's population (RIELL, 2003).

In Brazil, the results of dialysis census indicated that more than 73,000 patients are dependent on dialysis or renal replacement therapy (NRT), generating an annual cost of 2.0 billion reais. However, based on high-risk group, it is estimated a prospect that this number could double by 2010, ultrapassando 125 thousand cases (SESSO et al., 2008). According to the census conducted by the Brazilian Society of Nephrology (SBN) in 2001, Brazil had approximately 49,000 patients on dialysis, and an estimated incidence of 70,000 patients per million inhabitants, ie, an entry than 11,900 new patients program of dialysis. From these data, it is concluded that chronic renal disease in Brazil is mostly diagnosed late, and therefore not being done the recommended treatment (RIELL, 2003). The functional capacity of the population of chronic renal disease is still poorly explored and has not been established, however, some published data have shown wear in the skeletal muscles caused due to hemodialysis. According to Cheema et al. (2004), exercise intolerance and physical deconditioning, although not fully understood in this population, there are factors for negative impact, complex and multifactorial, resulting from changes in muscle perfusion, transfer of substrates, state-mediated accumulation of catabolites, metabolic acidosis, release of corticosteroids, oxidative stress and low physical activity. This clinical picture is related to muscle atrophy, myopathy and uremic malnutrition (JOHANSEN et al., 2000; STORER et al., 2005). There are some methods of assessing exercise capacity, which are used to determine prognosis, prescribe and determine their exercise programs and chronic renal failure patients (Bradley et al., 2000). Among the tests of functional exercise used in patients with chronic diseases, we can cite the test of distance walked in six minutes (DP6min). Developed by Balke (1963), as a simple test to determine functional capacity by measuring the distance traveled in a defined period of 12 minutes. It was later adapted for 6 minutes in patients with chronic respiratory diseases, since a longer time that it was very exhausting for people. Today is a test for patients with chronic diseases to measure functional status, to evaluate the tolerance and functional exercise capacity before and after an intervention, and the intensity of exercise to be planned and identify the limiting factors. It is a submaximal test capable of assessing global and integrated responses of all systems involved during exercise, including pulmonary and cardiovascular systems, systemic circulation and peripheral neuromuscular units and muscle metabolism (ATS, 2002). Shuttle Walk Test (SWT) is another test reported in the literature as the test that reproduces a maximum response in patients with chronic diseases, showing the velocity, capable of evaluating the capacity of exercise tolerance. It is a test similar to DP6min that correlates with maximal oxygen uptake (VO_{2max}), but is done in an incremental manner (Singh et al. 1994; REVILL et al., 1999, ATS, 2002).

METHODS

Data were collected from 30 patients, 17 men and 13 women older than 18 years of age with chronic kidney disease undergoing hemodialysis at the Kidney Institute of Londrina - Paraná at least three months, performing dialysis on average four hours per session three times a week with blood flow of 300-400 mL / min in machine Fresenius 4008 B (Fresenius Medical Care, Berlin, Germany) using a polysulfone dialyzer or cellulose acetate. We excluded patients with myocardial infarction less than six months, musculoskeletal limitations of the lower limbs that prevented the achievement of functional tests, symptomatic cardiovascular disease, chronic obstructive pulmonary disease (COPD), cognitive limitations, uncontrolled hypertension, acute myocardial infarction (AMI) or cerebrovascular accident (CVA) for less than six months and patients who participate regularly in any physical activity program. The research project was approved by the Ethics in Human Research of the Universidade Estadual de Londrina (UEL) and each patient signed a consent form. The test was conducted DP6min in interdiálise, a day after the second HD session of the week. For the tests the patients were advised to use shoes and comfortable clothes, not eating at least one hour before and not do any physical activity for 24 hours before testing. Before starting the tests the patients remained fifteen minutes rest in sitting position for stabilization of vital signs. After they were checked vital signs (blood pressure, heart rate and respiratory rate). The degree of dyspnea, pain or fatigue of the lower limbs were assessed by the scale of perceived exertion - Borg scale (BS). Patients were instructed to stop the tests only when they felt unable to tolerate stress or reached their highest degree of exhaustion. At the end of the tests, the distances were recorded and tested again the vital signs and level of perceived exertion. To test DP6min was followed to standardize the American Thoracic Society Statement (ATS) Guidelines for the Six-Minute Walk Test (2002), in which patients were instructed to walk as quickly as possible, 30 meters from the metro marked meters in a straight line between two cones, six minutes. Every minute patients were encouraged by standardized phrases and distance traveled was recorded. The predicted value for DP6min was calculated based on Troosters, (1999). The time spent on hemodialysis seen in

months was analyzed by collecting accomplished in the medical records of patients from admission to hemodialysis. The exercise capacity was determined by analyzing indirect VO₂max using the SWT, which is a walking test for symptom-limited effort, following the procedures described by Singh et al. (1994), where patients were instructed to walk around two cones separated by 10 meters, as long as possible, in accordance with the increasing speeds, under the guidance of a sound signal standard, issued by a CD player (disc player), and finalized by the patient for his intolerance to maximum effort. The test is interrupted by the examiner in charge when the patient can no longer reach the mark of two meters from the cone, or shows signs of physical exhaustion, according to a standardized test such as dyspnea, tachycardia, tachypnea, among others.

The indirect calculation of VO₂max was determined by the formula $4.19 + (0.025 * \text{total distance traveled})$, standardized for patients with chronic obstructive pulmonary disease, since there are no reports in the literature on this standardization for patients with chronic kidney disease.

| Physicals Characteristics | Sample (N = 30) |
|---------------------------|-----------------|
| Age (years) | 46,8±12 |
| Weight (Kg) | 68,4±13 |
| Height (m) | 1,64±0,1 |
| BMI (Kg/m ²) | 25,2± 3,7 |
| Kt/V | 1,2±0,8 |

Table 1. Physical characteristics of the sample. Values expressed as mean ± standard deviation. BMI = body mass index. Kt/V = rate of clearance of urea.

Statistical analysis Quantitative variables were expressed as mean and standard deviation. To correlate the time spent on hemodialysis and exercise capacity was used Coeficiente Pearson. Statistical significance was set to $\alpha = 5\%$ ($p < 0.05$). We used the program GraphPad Prism, version 3.0.

RESULTS

Table 1 shows the baseline characteristics of patients studied. The sample consists of 17 men (56.6%) and 13 women (43.4%), with a mean age of 46.8 ± 12 years, with body weight with a mean value of 68.4 ± 13 kg, and average height of 1.64 ± 0.1 m. The body mass index (BMI) mean was 25.2 ± 3.7 kg / m², and index of urea clearance by dialysis (Kt / V) showed values of 1.2 ± 0.8 .

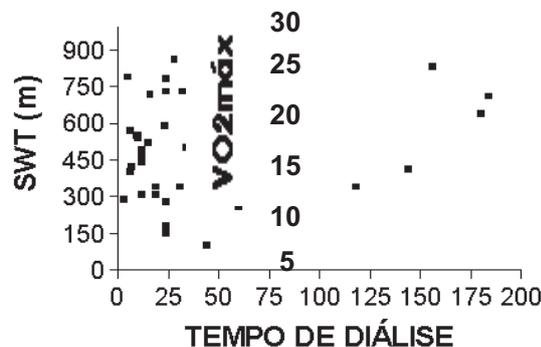


Figure 1 - Correlation between the time of stay in hemodialysis and exercise capacity

The average time spent on hemodialysis program was 50.6 ± 40 months. The functional capacity of patients evaluated by indirect analysis of VO₂ max testing through incremental SWT, showed values of 16.4 ± 3.4 ml / kg / min. The present study demonstrated a statistically significant correlation between the length of time in hemodialysis and exercise capacity of the selected sample determined by the Pearson's coefficient with $\alpha = 0.03$ and $r = -0.3$, as shown in Figure 1. This is, in this sample, the greater the residence time of renal patients in treatment in HD, the lower their ability to exercise.

DISCUSSION

The literature presents several studies that demonstrate the benefits of physical activity with mild to moderate regularly practiced in chronic renal failure (Kouider, 2002; PAINTER et al. 2005; CHEEMA, Smith and Singh, 2005). However, few of these studies involving physical exercise in hemodialysis population have been conducted in Brazil. Recently there were reports about the low level of physical activity in these patients that contributes to high cardiovascular risk, considered a cause of approximately 50% of deaths from chronic renal failure in the terminal phase (MANSUR, LIMA and Novaes, 2007; OH-PARK et al. 2002).

The functional exercise collected indirectly through the SWT, allowed the calculation of indirect VO₂max in ml / kg / min, the formula $4.19 + (0.025 * \text{total distance})$, used in patients with chronic obstructive pulmonary disease (Singh et al. , 1994), because there is a standardized formula for chronic renal patients. This sample showed lower values of VO₂max, indicating that their exercise capacity is low, in agreement with previous studies (Johansen et al., 2001; OH-PARK et al., 2002). However, this low exercise tolerance is still poorly understood in this population (CHEEMA et al., 2004). Another sample was analyzed in the time spent on dialysis program showing average values of 50.6 ± 40 months. And we can observe a significant correlation between the variables, ie, the greater the time spent on HD, the more exercise intolerance, expressed in VO₂ max (ml / kg / min). In the interpretation of our results, one should consider the difficulty in comparison with other studies, they were not found in the literature other similar studies, using the same variables and their correlations.

The HD is considered a palliative method in the treatment of uremic patients by replacing the function with the aim of promoting internal homeostasis of the organism, able to slow chronic kidney disease for the last stage (RIELL, 2003). However, in accordance with the increase of residence in HD there is a tendency of occurrence of metabolic and muscle, such as anemia, hyperparathyroidism, uremic myopathy, renal osteodystrophy that collaborate to physical deconditioning that population. However, it is believed in the existence of causative factors related to exercise intolerance, not yet fully established, such as age, disease duration, duration of hemodialysis, which together promote the pathophysiologic changes of chronic kidney disease associated with outbreaks hemodialysis. Results in the clinical picture commonly found in chronic kidney disease, with deficiency in the production of hemoglobin, muscle atrophy, muscle weakness, hyperparathyroidism, bone disease, heart disease, aside from inactivity.

Limitations of this study, we can mention the size of the sample and its heterogeneity. In addition, you can safely say that

the low exercise capacity is due to the constant use of dialysis or is due to uremia itself. Future studies are needed to evaluate the main cause of deconditioning of this population with consideration of additional factors such as disease duration, duration of treatment with dialysis, comorbidities among others.

CONCLUSION

We conclude that the level of exercise tolerance in chronic renal patients in this sample is low, caused by factors of negative impact multifactorial and complex not yet fully established in the literature. In addition, it was also observed that the population of uremic patients tend to stay a long period of hemodialysis therapy until renal transplantation is possible for maintenance of renal function and internal balance of the body. There was a correlation between the variables. The more time spent on hemodialysis, the lower the functional exercise. So there is a need to expand the knowledge in the field of nephrology, allowing the inclusion of therapeutic exercises for uremic patients, optimizing the dialysis treatment and providing improved functional capacity as an important adjunct in the treatment interdisciplinary and therefore improved quality of life in this population.

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CELEIDE PINTOAGUIAR PERES

State University of West of Paraná - UNIOESTE - PR

cperes@certto.com.br (Celeide Pinto Aguiar Peres)

Rua São Paulo, 769. ap 901 – Centro – Edifício Geminni

Cascavel – PR – Brasil - cep. 85.801.020 - Fone: (45) 3220-3157

CORRELATION BETWEEN THE TIME OF STAY IN HEMODIALYSIS AND EXERCISE CAPACITY

ABSTRACT

Introduction: The characteristics of exercise intolerance of patients with CKD are still largely unexplored and has not been established. The low exercise tolerance and physical deconditioning, although not fully understood in this population is by factors of negative multifactorial and complex. **Objective:** To correlate exercise capacity of patients with Chronic Kidney Disease (CKD) on dialysis, with time spent in hemodialysis patients with chronic renal failure, providing scientific information to professionals in this specialty in order to better establish the evaluation criteria and rehabilitation for this population. **Métodos:** We analyzed 30 patients (17 men) with mean age 46.8 ± 12 years, duration of dialysis was 50.6 ± 40 months and kt/V of 1.2 ± 0.2 ; on dialysis for at least 3 months. The exercise capacity was assessed by the distance walked in six minutes (DP6min) analysis and indirect maximum oxygen consumption (VO_{2max}) by means of the Shuttle Walk Test (SWT), made in interdiálise. Statistical analysis of quantitative variables, the results were expressed as means and standard deviations. To correlate the time spent on hemodialysis and exercise capacity, we used the Pearson's coefficient. Statistical significance was set to $\alpha = 5\%$ ($p < 0.05$). We

used the program GraphPad Prism, version 3.0. **Results:** After treatment, the mean distances obtained on test DP6min, showed an increase of 11% (55.9 meters), with a statistically significant ($p < 0.01$). Between the first and second evaluation, there was no difference between the variables. **Conclusion:** The exercise capacity in patients with CKD is low, but two months of physical exercise during hemodialysis were sufficient to improve the physical condition of these patients.

KEYWORDS: exercise capacity, chronic renal disease, hemodialysis

RÉSUMÉ

Introduction: Les caractéristiques de l'intolérance à l'exercice des patients atteints de néphropathie chronique sont encore largement inexplorées et n'a pas été établie. La faible tolérance à l'exercice et le déconditionnement physique, bien que pas entièrement compris dans cette population est par des facteurs négatifs de multifactoriel et complexe. Objectif: Mettre en relation la capacité d'exercice des patients atteints de maladie rénale chronique (IRC) sur la dialyse, avec le temps passé chez les patients hémodialysés présentant une insuffisance rénale chronique, fournissant des informations scientifiques pour les professionnels de cette spécialité afin de mieux établir les critères d'évaluation et de réhabilitation de ce population. Méthodes: Nous avons analysé 30 patients (17 hommes) avec un âge moyen $46,8 \pm 12$ ans, la durée de la dialyse a été de $50,6 \pm 40$ mois et Kt / V de $1,2 \pm 0,2$; sous dialyse pendant au moins 3 mois. La capacité d'exercice a été évaluée par la distance parcourue en six minutes (DP6min) analyse et indirects de la consommation maximale d'oxygène (VO_2 max) par l'intermédiaire de la navette Walk Test (SWT), tourné en interdiálise. L'analyse statistique des variables quantitatives, les résultats ont été exprimés sur les moyens et les écarts-types. De corréler le temps consacré à l'hémodialyse et la capacité d'exercice, nous avons utilisé le coefficient de Pearson. La signification statistique a été fixé à $\alpha = 5\%$ ($p < 0,05$). Nous avons utilisé le programme GraphPad Prism, version 3.0. Résultats: Après traitement, les distances moyennes obtenues sur test DP6min, a montré une augmentation de 11% (55,9 mètres), avec une différence statistiquement significative ($p < 0,01$). Entre la première évaluation et, deuxièmement, il n'y avait pas de différence entre les variables. Conclusion: la capacité d'exercice chez les patients atteints de néphropathie chronique est faible, mais deux mois de l'exercice physique pendant l'hémodialyse ont été suffisantes pour améliorer la condition physique de ces patients.

MOTS-CLÉS: exercice physique, la maladie rénale chronique, l'hémodialyse

RESUMEN

Introducción: Las características de la intolerancia al ejercicio de los pacientes con enfermedad renal crónica son todavía en gran parte inexplorado y no ha sido establecida. La tolerancia al ejercicio y la pérdida de condición física bajo, aunque no se entiende en esta población es por factores negativos de multifactorial y complejo. Objetivo: correlacionar la capacidad de ejercicio de los pacientes con insuficiencia renal crónica (CKD) en diálisis, con el tiempo empleado en pacientes en hemodiálisis con insuficiencia renal crónica, proporcionando información científica a los profesionales en esta especialidad con el fin de establecer mejor los criterios de evaluación y la rehabilitación de este población. Métodos: Se analizaron 30 pacientes (17 hombres) con una media de edad de $46,8 \pm 12$ años, duración de la diálisis fue de $50,6 \pm 40$ meses y Kt / V de $1,2 \pm 0,2$; en diálisis durante al menos 3 meses. La capacidad de ejercicio se evaluó la distancia caminada en seis minutos (DP6min) análisis e indirectos de consumo máximo de oxígeno (VO_2 max) por medio de la Shuttle Walk Test (SWT), realizada en interdiálise. El análisis estadístico de las variables cuantitativas, los resultados fueron expresados como medias y desviaciones estándar. Para correlacionar el tiempo dedicado a la hemodiálisis y la capacidad de ejercicio, se utilizó el coeficiente de Pearson. La significación estadística se estableció en $\alpha = 5\%$ ($p < 0,05$). Se utilizó el programa GraphPad Prism, versión 3.0. Resultados: Después del tratamiento, las distancias medias obtenidas en la prueba de DP6min, mostró un aumento del 11% (55,9 metros), con un aumento estadísticamente significativo ($p < 0,01$). Entre la primera evaluación y en segundo lugar, no hubo diferencia entre las variables. Conclusión: La capacidad de ejercicio en pacientes con enfermedad renal crónica es baja, pero dos meses de ejercicio físico durante la hemodiálisis fueron suficientes para mejorar la condición física de estos pacientes.

PALABRAS CLAVE: la capacidad de ejercicio, la enfermedad renal crónica, la hemodiálisis

CORRELAÇÃO ENTRE O TEMPO DE PERMANÊNCIA EM HEMODIÁLISE E A CAPACIDADE DE EXERCÍCIO

RESUMO

Introdução: As características da intolerância ao exercício de pacientes com DRC ainda são pouco exploradas e não têm sido estabelecidas. A baixa tolerância ao exercício e descondicionamento físico, apesar de não totalmente compreendidos nesta população, ocorre por fatores de impacto negativo multifatoriais e complexos. Objetivo: Correlacionar a capacidade de exercício dos pacientes com Doença Renal Crônica (DRC) em programa de hemodiálise, com o tempo de permanência em hemodiálise dos pacientes renais crônicos, fornecendo dados científicos aos profissionais que atuam nesta especialidade, para melhor estabelecerem critérios de avaliação e reabilitação para esta população. Métodos: Foram analisados 30 pacientes (17 homens), com média de idade $46,8 \pm 12$ anos, tempo de diálise de $50,6 \pm 40$ meses e de kt/V de $1,2 \pm 0,2$; em programa de hemodiálise há pelo menos 3 meses. A capacidade de exercício foi avaliada pelo teste de distância percorrida em seis minutos (DP6min) e a análise indireta do consumo máximo de oxigênio (VO_2 máx) por meio do teste Shuttle Walk Test (SWT), realizados na interdiálise. Para análise estatística das variáveis quantitativas, os resultados foram expressos em médias e desvios-padrão. Para correlacionar o tempo de permanência na hemodiálise e a capacidade de exercício utilizou-se o Coeficiente de Pearson. A significância estatística foi estabelecida para $\alpha = 5\%$ ($p < 0,05$). Foi utilizado o programa GraphPad-Prism versão 3.0. Resultados: Após o tratamento, a média dos valores das distâncias percorridas no teste DP6min, apresentou aumento de 11% (55,9 metros), com diferença estatisticamente significativa ($p < 0,01$). Entre a primeira e a segunda avaliação, não houve diferença entre as variáveis. Conclusão: A capacidade de exercício em pacientes com DRC é baixa, mas dois meses de prática de exercícios físicos durante a hemodiálise foram suficientes para melhorar o condicionamento físico destes pacientes.

PALAVRAS-CHAVE: capacidade de exercício, doença renal crônica, hemodiálise

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