Impact of an intradialytic exercise program on body composition, phase angle and functional capacity

[1]Vieira S, [1]Rodrigues R, [2]Moreira I, [2]Cabecinhas B, [1]Silva A

1DaVita Gondomar, Portugal; 2DaVita Leiria, Portugal

Introduction

Compared to the general population people undergoing hemodialysis (HD) are less active, have a lower exercise tolerance and experience physical deconditioning manifesting as muscular atrophy, anaemia, uraemic myopathy/neuropathy, reduction of muscle strength (MS) and malnutrition. **Bioimpedance (BIA)** is a tool to evaluate a number of parameters within body compartments including **muscle mass (MM)**, **fat mass (FM)** and **cell mass (CM). Phase angle (PA°)** derived from BIA is a measure related to cell mass and has been used as a predictor of health and survival in these patients. Functional status has been assessed by functional capacity tests such as "Hand Grip Test" (HGT) and "Sit to Stand Test" (STST), which allow the assessment of a patient's capacity to perform their activities of daily living (ADLs) safely, independently and without fatigue.

The objective of this study was to evaluate the impact of an intradialytic physical exercise program (PEP) on the body composition and functional status of patients in HD using a number of BIA measures

Method

- **Fifty-five** patients (**22 males and 33 females**) with a **mean age of 65.0 ± 14.2 years** (min. 32 years and max. 88 years) were included in the PEF and **who did HD** about **5.8 ± 4.0 years** (min 3 years and max 15 years, median 4 years).
- The intervention consists of an intradialytic aerobic exercise program in cycle ergometer and also isotonic exercises with repetition and series planning.
- Progression in exercise planning is performed every 3 months after functional test performance evaluation**.**
- These were evaluated at the beginning of the study and every 3 months by the following methods: **BIA** (MM, FM%, CM, cell mass index in kg / m2_CMI, PA°), **anthropometric parameters** (weight, height and body mass index in kg / m2_BMI), **biochemical parameters** (albumin and CRP) and the application of **functional tests** (HGT and STST).
- Data were treated in SPSS 24.0 (Wilcoxon test for comparison of paired variables and Spearman correlation).

Results

- **7** patients had PEF **3 months**, **16** patients **6 months**, **5** patients **9 months**, **25** patients **12 months** and only **2** patients **15 months**.

Nutritional status

Obesity

- From BMI assessment, 21 patients (39.6%) were overweight (25 <BMI <30) and only 10 (18.9%) were obese patients (BMI ≥ 30 kg / m2).
- From the BIA assessment 16 women (> 25% FM) and 28 men (> 15% FM) had excess fat mass (% FM) at the beginning of the study.

Malnutrition

- From the BMI assessment, 1 patient presented low weight (BMI <18.5 kg / m2)
- From the BIA assessment, 3 patients (5.5%) showed low values of PA (PA <4°); and 9 patients had CMI values below 8 kg / m2.

Body Composition and Functional Capacity

Fat mass (FM): A decrease was observed in patients over the 12 months of PEP (% FM; Start: 29.4 ± 11.8 vs. 12 months: 26.7 ± 12.5).
Muscle Mass and Muscular Strength (HGT): No significant difference was found in MM, however, HGT increased throughout the PEF, with statistical significance from the 6th month of the program.
Sit to Stand Test: There was a significant increase throughout the study.
Cell Mass (CM): Cell mass increased over time with statistical significance as of the 6th month.
Cell Mass Index: increased throughout the study, with statistical significance in patients with 12 months of PEF (CMI, start: 10.2 ± 2.3 vs. 12 m: 11.8 ± 2.0, p <0.05).
Phase Angle: increased over the study period, with statistical significance from the start of the study for the first three months (Spearman rank correlation)
Anthropometric/biochemical parameters: No significant difference over three months

PA°	ρ	p
Age	- 0,30	<0,05
MM (kg)	0,39	<0,05
CM (kg)	0,39	<0,05
HGT	0,49	<0,05

Table 1: Spearman correlation

	Initial	3 M	6 M	9 M	12 M	Chi - Squared	P (**)
Body Composition							
MM(Kg)	26,3 ± 6,2	26,0 ± 6,7	26,6 ± 6,4	25 ± 4,2	26,9 ± 6,1		n.s.**
FM(%)	29,4 ± 11,8	30,5 ± 12,6	27,0 ± 11,7	32,7 ± 12,3	26,7 ± 12,5 (*)		n.s.**
CM(Kg)	30,9 ± 6,4	30,7 ± 6,8	31,3 ± 6,9 (*)	31,4 ± 4,3 (*)	32,0 ± 6,1 (*)		n.s.**
CMI (Kg/m^2)	10,2 ± 2,3	9,9 ± 2,4	10,4 ± 2,5	10,0 ± 2,4	11,8 ± 2,0 (*)	14,6	<0,01**
PA(°)	5,4 ± 1	5,5 ± 1,3 (*)	5,7 ± 1,4 (*)	5,3 ± 1,0	6,0 ± 1,7 (*)		n.s.**
Functional Tests							
HGT (Kg)	24,0± 12,5	26,4 ± 13,4	26,3 ± 13,9 (*)	24,4 ± 12,5 (*)	31,8 ± 11,1(*)	40,3	<0,01**
STST	14,8 ± 6,9	15,3± 6,5(*)	16,6 ± 2,9 (*)	16,1 ± 6,8 (*)	17,6 ± 1,5 (*)	56,1	<0,01**
Biochemistry							
Albumin	4,1 ± 0,2	4,0 ± 0,3	4,1 ± 0,2	4,1 ± 0,2		14,3	<0,01**
RCP	1,0 ± 1,9	0,9 ± 1,7	0,8 ± 1,0	0,8 ± 1,0	0,8 ± 1,0		n.s.**
Anthropometric Parameters							
Weight (Kg)	69,1 ± 12,6	69,3 ± 12,2	68,9 ± 12,2	70,9 ± 11,2	69,2 ± 13,3		n.s.**
BMI (Kg/m^2)	25,9 ± 4,5	26,1 ± 4,4	25,9 ± 4,4	27,2 ± 4,9	24,8 ± 7,2		n.s.**

(*) p <0,05; Wilcoxon Test for comparing paired variables
(**)p<0,05 Friedman test for comparison between several variables, non-parametric

Table 2: Change in body composition, functional test, biochemical and anthropometric parameters over 12 months after PEP participation

Conclusion

No significant changes were found in body composition over the time of participation in the PEP, however, there was an increase in phase angle in the beginning three months suggestive of improved cellular health and functional status.
This is supported by the increase in MS evidenced throughout the study with possible benefits in independence for the patient. In this way, they can overcome the deceleration of functional decline and improve the capacity to perform daily life activities.
One can also conclude that with a simple and economic intradialytic exercise program, it is possible to improve functional capacity without harming dialysis adequacy.
Rehabilitation nurses should include the interdisciplinary team that takes care of hemodialysis patients.

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