J Nephropharmacol. 2019; 8(1): e01.

http://www.jnephropharmacology.com DOI: 10.15171/npj.2019.01

Journal of Nephropharmacology

Rapid assessment of physical activity score in maintenance hemodialysis patients with nutritional assessment

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ARTICLEINFO

Article Type:
Original

Article History:
Received: 20 July 2018
Accepted: 15 November 2018
ePublished: 5 December 2018

Keywords:
Exercise
Hemodialysis
Muscle strength
Chronic kidney disease

ABSTRACT

Introduction: There is a paucity of data from India regarding the physical activity assessment of hemodialysis patients.
Objectives: The objective of this study was to determine the level of physical activity and nutritional status of Indian dialysis patients.
Patients and Methods: This cross-sectional multicenter study was conducted in two tertiary care centers. The physical activity of 116 patients was assessed by the Rapid Assessment of Physical Activity (RAPA) questionnaire and correlated with various biochemical parameters of nutrition.
Results: We divided the patients based on serum albumin level into group 1 (≤ 3.5 g/dL) and group 2 (>3.5 g/dL). The mean RAPA-1 scores of both groups were suboptimal; group 1 had a mean score of 2.514 ± 0.901 and group 2 had a mean score of 3.215 ± 1.257 ($P=0.003$). The mean handgrip strength of group 1 was 35.222 ± 13.568 kg and that of group 2 was 41.472 ± 17.874 kg ($P=0.062$).
Conclusion: These results should alert physicians taking care of maintenance hemodialysis patients to improve nutritional status and thereby physical activity to ensure better outcomes.

Implication for health policy/practice/research/medical education:
To determine the level of physical activity and nutritional status of Indian dialysis patients, we conducted a study on 116 hemodialysis patients by the Rapid Assessment of Physical Activity questionnaire and correlated with various biochemical parameters of nutrition. This study showed that hemodialysis patients in India have low levels of physical activity, handgrip strength and suboptimal levels of biochemical parameters of nutrition.
Please cite this paper as: Varghese V, Vijayan M, Abraham G, Nishanth S, Mathew M, Parthasarathy R, Mancha N. Rapid assessment of physical activity score in maintenance hemodialysis patients with nutritional assessment J Nephropharmacol. 2019;8(1):e01. DOI: 10.15171/npj.2019.01

Original

Introduction

Chronic kidney disease (CKD) patients on dialysis have a lower level of physical activity and nutritional parameters compared with age and sex-matched controls (1,2). Chronic kidney disease stage 5 (CKD dialysis; CKD-5D) is associated with anemia, decreased cardiac function, changes in skeletal muscle strength that result in decreased aerobic capacity. Muscle atrophy is a major cause of poor exercise capacity, which is linked to both malnutrition and inflammation (3-6). Low exercise tolerance may result in poor quality of life, increased cardiovascular risk or even sudden death (7,8). Recently, there has been a growing attention towards improving physical activity of dialysis patients, though there is a lack of evidence of survival benefit through exercise programmes from long term randomized controlled trials (9-11). In CKD-5D patients with morphologic, electrophysiological and metabolic changes of uremia, steps should be taken to improve muscle strength (12,13).

There is a paucity of published data on the physical activity of Indian CKD dialysis (CKD-5D) patients. As there is only one nephrologist per 800 000 population in India, nephrologists are often overburdened with patients, especially in government hospitals (14). There is an imminent need for a simple tool to assess the level of physical activity in Indian dialysis patients

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and to possibly improve patient outcomes. The Rapid Assessment of Physical Activity (RAPA) questionnaire has been shown to have 81% sensitivity and 69% specificity in the assessment of malnutrition in old patients (15). RAPA-1 score corresponds to aerobic activity and RAPA-2 score corresponds to muscle strengthening or stretching exercises. There is a direct correlation between physical activity and serum albumin levels and hence, serum albumin and pre-albumin have been widely used as indicators of nutritional status, reflective of visceral protein stores (1,16-18).

Objectives

This cross-sectional multi-centre study was done to assess the level of physical activity using RAPA score, handgrip strength, and dietary supplementation in Indian CKD-5D patients and correlate with nutritional parameters and vintage of dialysis.

Patients and Methods

Study design

This cross-sectional multi-centre study was conducted in two tertiary care centers, in southern India, at the Madras Medical Mission Hospital and Pondicherry Institute of Medical Sciences. The study included 116 prevalent maintenance hemodialysis patients, comprising of 76 males and 40 females belonging to an age group of ≤ 60 years (71.55%), >60 years (28.45%). The dietary patterns included pure vegetarian diet (18), ovo-vegetarian (4) and non-vegetarian diet (94). Among the group of patients, 94.83% were found to be hypertensive on anti-hypertensives, while 37.07 % had type 2 diabetes mellitus. Eight patients had coronary artery disease, 2 patients had chronic obstructive pulmonary disease (COPD), and one patient had bilateral below knee amputation. Sixty four patients (55.17%) underwent dialysis twice per week 4 hours using either AV fistula, or in a minority with permcath or AV graft, and 52 patients (44.83%) underwent dialysis thrice per week. Of the dialysis patients, 6.03% had a history of previous fractures and 1.72% had a history of osteoarthritis. All patients were taking some form of B complex vitamin tablets, 25 patients were taking carnitine supplements and 52 patients were receiving erythropoiesis-stimulating agents (ESAs).

The physical activity of these patients was assessed using RAPA score as shown in Table 1. The RAPA questionnaire is based on a scale of 1-7 measuring the amount and intensity and duration of physical activity that a person does. A score of 5 or below signifies sub-optimal physical activity and that of 6 or above signifies optimal physical activity. The activities are divided into light, moderate and vigorous activities. Patients with specific joint pain were then assessed by the Oxford scales for hip and knee joint pain and the modified Oswestry low back questionnaire for low back pain (16). Handgrip on the non-AV fistula/non-AV graft arm was assessed for all patients with the help of CAMRY (model; EH101) electronic hand dynamometer which records a maximum of 90 kg. Those patients with previous stroke with weakness of the non-fistula arm were excluded.

The following biochemical parameters were collected from the patients; hemoglobin, pre-dialysis serum albumin, intact parathyroid hormone level (iPTH), and 25-hydroxy vitamin D3 levels. When the assessment was done, none of the patients had ongoing acute inflammation. Intact parathyroid hormone and vitamin D3 levels were available only for 46 and 47 patients respectively. Handgrip for each patient was recorded in the non-fistula arm.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. Ethical clearance was obtained from the institutional ethical committee. Informed written consent was obtained from all the study participants.

Statistical analysis

Means of continuous variables were compared using independent samples *t* test. Correlation of physical activity with vintage of dialysis was done using Pearson's correlation coefficient. The level of significance was taken at *P* value <0.050.

Results

Table 2 shows the demographic details, comorbidities and nutritional supplements taken by the patients. The mean RAPA-1 score of our patients was 2.991 ± 1.198, and the mean handgrip strength was 39.478 ± 16.819 kg. Ninety percent of the patients were found to have weak handgrip

Table 1. Rapid assessment of physical activity questionnaire

RAPA	S No	Activity	Yes	No
RAPA 1	1	I rarely or never do physical activities		
	2	I do some light or moderate physical activities, but not every week		
	3	I do some light physical activity every week		
	4	I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week		
	5	I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week		
	6	I do 30 minutes or more a day of moderate physical activities, 3 or more days a week		
	7	I do 20 minutes or more a day of vigorous physical activity, 3 or more days a week		
RAPA 2	8	I do activities to increase muscle strength, such as lifting weights or calisthenics, once a week or more		
	9	I do activities to improve flexibility such as stretching or yoga once a week or more		

Table 2. Demographic details, comorbidities and nutritional supplements taken by the patients

		No.	%
Age	≤ 60 years	83	71.55
	> 60 years	33	28.45
Gender	Male	76	65.52
	Female	40	34.48
Dietary patterns	Vegetarian	18	15.52
	Ovo-vegetarian	4	3.45
	Non-vegetarian	94	81.03
Hypertension	Yes	110	94.83
	No	6	5.17
Diabetes mellitus	Yes	43	37.07
	No	73	62.93
Dialysis sessions per week	Twice weekly	64	55.17
	Thrice weekly	52	44.83
Vitamin supplements	Yes	116	100
	No	0	0
Carnitine supplements	Yes	25	21.55
	No	91	78.45
ESA injections	Yes	52	44.83
	No	64	55.17

strength, and 91% were found to have suboptimal physical activity by the RAPA score. Eleven patients were doing stretching exercises every week corresponding to a RAPA-2 score of 2, and all the other 105 patients had no muscle strengthening or stretching activities. Twenty six patients complained of knee pain, out of which 4 patients had mild to moderate pain, 6 patients had moderate to severe pain, 15 patients had severe pain, and 3 patients had satisfactory pain on using the Oxford scale. Only two patients complained of hip pain, both of them had satisfactory measure on the Oxford hip scale. Two patients complained of low back pain, one moderate and one satisfactory using the modified Oswestry low back questionnaire for low back pain.

We assessed the relationship of these scores with serum albumin level, by dividing the patients into 2 groups; group 1 comprised of 37 patients having a serum albumin <3.5 g/dL and group 2 comprised of 79 patients having a serum albumin ≥3.5 g/dL. The mean RAPA score of both groups were suboptimal; group 1 had a mean score of 2.514 ± 0.901 and group 2 had a mean score of 3.215 ± 1.257, as shown in Figure 1 (P=0.003). The mean handgrip strength of group 1 was 35.222 ± 13.568 kg and that of group 2 was 41.472 ± 17.874 kg, as shown in Figure 2 (P=0.062). Those patients who consumed a non-vegetarian diet (3.106 ± 1.240, n=94) had a higher mean RAPA score than those who consumed vegetarian diet, though not statistically significant (2.722 ± 0.752, n=18) (P=0.207). Figure 3 shows the comparison of RAPA score between non-vegetarians and vegetarians.

Those with optimal level of physical activity (n=10) according to the RAPA score had a mean hemoglobin of 9.570 ±1.703 g/dL, while those with suboptimal physical activity (n=106) had a mean hemoglobin level of 8.621

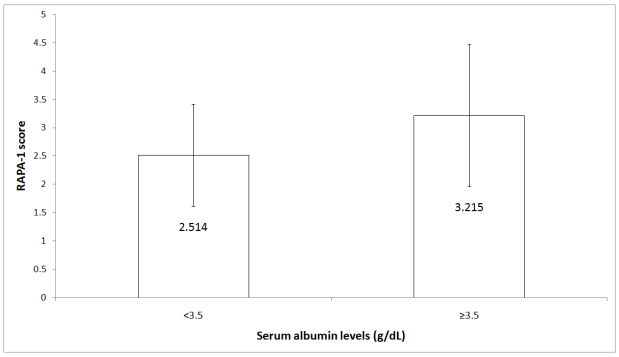

Figure 1. Comparison of RAPA-1 score between group 1 and group 2 (P=0.003).

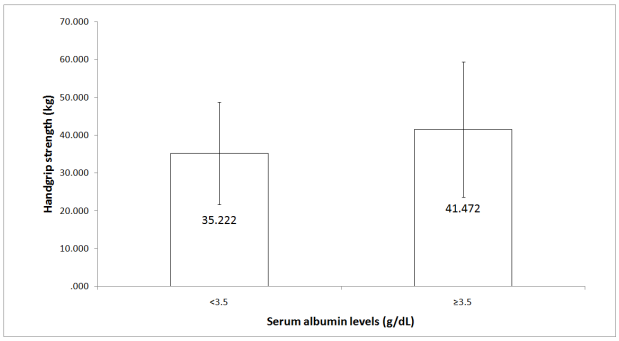

Figure 2. Comparison of handgrip strength between group 1 and group 2 (P=0.062)

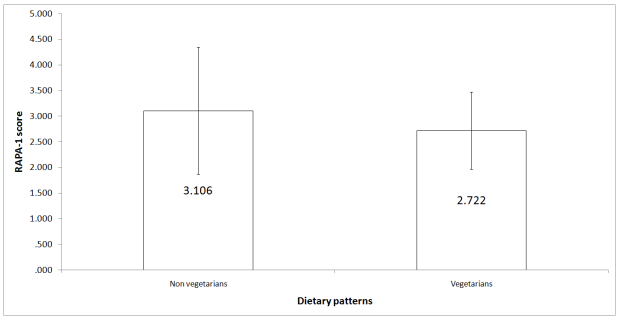

Figure 3. Comparison of RAPA-1 score between non vegetarians and vegetarians (P=0.207)

± 1.861 g/dL (P=0.123). The mean vitamin D level amongst those with optimal physical activity was 32.000 ± 15.046 ng/mL (n=6) compared to those with suboptimal physical activity who had a vitamin D of 21.346 ± 10.129 ng/mL (n=41) (P=0.029). The intact parathyroid hormone levels did not show any statistically significant difference between those with optimal physical activity (331.914 ± 226.849 pg/mL, n=7) compared to those with suboptimal physical activity (n=39) who had a mean intact parathyroid hormone level of 399.074 ± 226.237 pg/mL (P=0.474). There was no relationship between RAPA score and vintage of hemodialysis in years (r=-0.063,

$P = 0.499$).

Discussion

The causes of poor physical capacity in CKD-D patients are multifactorial. Nevertheless, due to the association of poor physical capacity with adverse outcomes, it becomes imperative to assess physical activity of patients regularly and encourage aerobic exercise in CKD-5D patients. In a developing country like India, with grossly overburdened healthcare facilities, we require an easy-to-administer tool to assess the level of physical activity of patients, so that steps can be taken at an early period to improve quality of life and survival. We selected the RAPA score and handgrip strength for this purpose, and correlated it with nutritional parameters. Previous studies have shown an association between the level of physical activity and nutritional status among CKD-5D patients (1,19-21).

The majority of our patients had suboptimal physical activity and poor handgrip strength. Many of these people are working part-time for their livelihood. Lower levels of physical activity were seen in patients who had serum albumin less than 3.5 g/dL and vegetarians, which is likely to be due to malnutrition which is highly prevalent in Indian CKD-5D patients. The average meat consumption in India is 2.9 kg per person per year, which is the among the lowest in the world, far below the global average (18). In our units, we after repeated counselling by skilled dieticians observe an average dietary intake of 1-1.2 g/kg body weight of protein per day, 1800-2000 calories per day and have a low potassium and phosphorus diet. This calls for nutritional assessment and interventions in every dialysis unit to improve protein energy wasting (PEW). However, we did not find any significant association between level of physical activity and vintage of hemodialysis, which is surprising. In one of our previous studies, we found that the consumption of high biological value protein was found to be lower than recommended standards (17). Thus, there is an urgent need for interventions to increase physical activity and nutritional intake by skilled physiotherapists and nutritionists. Aerobic and resistance exercise are beneficial not only in improving physical functioning, but also in improving anthropometrics, nutritional status, hematological indices, inflammatory cytokines, depression, and health-related quality of life (8). This can be done using tools such as recumbent exercise cycle ergometers.

Moreover, these patients were selected from non-profit tertiary care centers, and they can afford dialysis through out-of-pocket payments because of lack of widespread health insurance coverage in India. It is probable that those patients at and below the poverty line, who avail dialysis at free-of-cost facilities, could have worse physical activity levels than those observed in our study.

Conclusion

This multi-centre study showed that CKD-5D patients in India have low levels of physical activity, handgrip strength and suboptimal levels of biochemical parameters of nutrition. The RAPA score and handgrip strength were used as tools to assess physical strength which provided valuable information in this cross sectional study. However, prospective longitudinal studies are needed to determine whether modification of nutritional intervention can improve physical performance in patients on maintenance hemodialysis, and whether improvement in physical activity is associated with improvement in survival. Although a cross sectional study, the results should alert physicians who are taking care of maintenance hemodialysis patients to improve nutritional status and thereby physical activity that may lead to better outcomes and less hospitalization.

Study limitations

The main limitation of this study is that this is a cross-sectional study and it does not provide information on the effect of improvement of nutritional status and physical activity on quality of life in dialysis patients. The data on vitamin D levels and intact parathyroid hormone levels were not readily available in all the patients, and the analysis was done in a smaller subset of patients.

Authors' contribution

VV, GA and MM designed the study, observed accuracy and validity of the study. VV, MV, SN and NM collected the data and followed the study. GA, MV and RP supervised the project. VV and MV wrote the paper. All authors edited and revised the final manuscript and accepted its publication.

Conflicts of interest

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

Funding/Support

None.

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