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Avaliação de programa de ensino-aprendizagem sobre metabolismo de cálcio e fósforo para pacientes em hemodiálise
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Evaluation of an educational program on calcium and phosphorus metabolism for patients on hemodialysis

AVALIAÇÃO DE PROGRAMA DE ENSINO-APRENDIZAGEM SOBRE METABOLISMO DE CÁLCIO E FÓSFORO PARA PACIENTES EM HEMODIÁLISE

EVALUACIÓN DE PROGRAMA DE ENSEÑANZA-APRENDIZAJE SOBRE METABOLISMO DE CALCIO Y FÓSFORO PARA PACIENTES EN HEMODIÁLISIS

Lílian Peres Righetto de Araujo[1], Ana Elizabeth Prado Lima Figueiredo[2], Domingos Otavio Lorenzoni d'Avila[3]

ABSTRACT

This cohort study evaluated the effects of an educational program about metabolism and control of serum levels of calcium (Ca), phosphorus (PO4), parathormone (PTH), Ca x PO4 product on 33 stable patients on hemodialysis. Patients were randomized into two groups: control (n=17) and intervention (n=16). The control group received information on vascular access. The intervention group was informed about Ca, PO4 and PTH metabolism. The changes in knowledge were evaluated using tests. Treatment compliance was assessed by serial laboratory tests. No significant change was observed in their knowledge [intervention: 8/17 vs. 14/17 competent patients before and after class, respectively (P<0.001); control: 11/16 vs. 13/16 competent patients, respectively (P<0.001)]. A reduction was observed in PO4 and Ca x PO4 product between time 0 and 1 in both groups and between time 1 and 2 in the control group. The program did not induce changes in knowledge or behavior. In conclusion, chronic renal patients should be offered continuous educational programs.

KEY WORDS

Health education.
Patients.
Renal dialysis.
Calcium.
Phosphorus.

RESUMO

Estudo de corte avaliando efeitos de programa de ensino-aprendizagem sobre o metabolismo e controle de níveis séricos de cálcio (Ca), fósforo (PO4), paratormônio (PTH), produto Ca x PO4, em 33 pacientes estáveis em HD, randomizados para dois grupos: Controle (n=17) e Intervenção (n=16). O grupo Controle recebeu informação sobre acesso vascular: a Intervenção sobre metabolismo de Ca, PO4 e PTH. Mudanças de conhecimento avaliadas por testes pré e pós-classe; adesão à terapia por dosagens laboratoriais seriadas. Não houve mudança significativa de conhecimento em qualquer grupo [Intervenção: 8/17 vs. 14/17 pacientes competentes no pré e pós-teste, respectivamente (P<0.001); Controle: 11/16 vs. 13/16 pacientes competentes, respectivamente (P<0.001)]. Houve redução de PO4 e produto Ca x PO4 entre tempos 0 e 1 em ambos os grupos e entre tempos 1 e 2 no grupo Controle. Concluiu-se que o programa não induziu mudança de conhecimento ou comportamento e que os programas de ensino-aprendizagem para renais crônicos devem ser contínuos.

DESCRITORES

Educação em saúde.
Pacientes.
Diálise renal.
Cálcio.
Fósforo.

RESUMEN

Estudio de cohorte evaluando efectos de programa de enseñanza-aprendizaje sobre el metabolismo y control de niveles séricos de calcio (Ca), fósforo (PO4), parathormona (PTH), producto Ca x PO4 en 33 pacientes estables en HD, randomizados para dos grupos: Control (n=17) e Intervención (n=16). El grupo Control recibió información sobre acceso vascular; el grupo Intervención, sobre metabolismo de Ca, PO4 y PTH. Cambios de conocimiento evaluadas por pruebas pre y post clases, adhesión a la terapia por dosajes laboratoriales seriados. No existió cambio significativo de conocimiento en cualquier grupo [Intervención: 8/17 vs 14/17 pacientes competentes en las etapas pre y post prueba, respectivamente (P<0,001); Control: 11/16 vs. 13/16 pacientes competentes, respectivamente (P<0,001)]. Existió reducción de PO4 y producto Ca x PO4 entre momentos 0 y 1 en ambos grupos y entre momentos 1 y 2 en el grupo Control. El programa no indujo cambios de conocimiento o comportamiento. Los programas de enseñanza-aprendizaje para enfermos renales crónicos deben ser continuos.

DESCRIPTORES

Educación en salud.
Pacientes.
Diálisis renal.
Calcio.
Fósforo.

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INTRODUCTION

Virtually all patients with Chronic Renal Failure (CRF) display increased levels of serum phosphorus (PO_4). High levels of PO_4 and calcium x phosphorus product (Ca x PO_4) play a central role in vascular and soft tissue calcification, secondary hyperparathyroidism and renal osteodystrophy. Inadequate control of PO_4 is associated with increased mortality, especially of a cardiovascular nature[1-4].

Reduced enteric absorption of PO_4 is crucial to preventing hyperphosphatemia and secondary hyperparathyroidism that develops with CRF. Since PO_4 is absorbed from diet, patients with advanced CRF should follow a diet restricted in PO_4 to control their serum levels, though this measure is usually insufficient and most patients are required to use PO_4 binders[5].

CRF treatment requires patients to rigorously adhere to a restricted diet and medications. Physiological changes resulting from the disease lead to changed habits and practices, especially eating habits, and the adoption of a diet with diminished consumption of proteins, sodium, potassium, phosphorus and water[6] is required. The perspective of rehabilitation is significantly reduced in patients who do not adhere to the therapeutic regimen. The multiple therapeutic measures and dietetic limitations associated with a lack of information on the part of patients and family members contribute to treatment non-adherence. These restrictions are always rigorous and the degree of assimilation and treatment adherence differs among individuals depending on the importance they attribute to their own life, the way significant people view this condition, and the support they receive[6].

It is known that to understand the treatment patients go through a personal process in which they translate information provided by the team into a language that makes sense to them...

Additionally, the prevalence of depression in this population is not to be ignored, which can limit one's treatment adherence[7]. It is estimated that non-adherence to treatment is higher than 80%[8]. It is known that to understand the treatment patients go through a personal process in which they translate information provided by the team into a language that makes sense to them, specifically, information is classified according to common sense categories of "health" and "disease", which every person possesses in his/her repertory of knowledge. Therefore, guidance needs to be adapted to the level of knowledge and understanding of each patient[8-9].

OBJECTIVES

This study evaluated the effect of a short-duration educational program addressing serum levels of calcium (Ca), PO_4, parathyroid hormone (PTH), and Ca x PO_4 product, and also behavioral change in stable CRF patients undergoing hemodialysis (HD) treatment.

METHOD

This is a cohort study in which an educational program was implemented among CRF patients undergoing HD in the São Lucas Hospital at the *Pontifícia Universidade Católica Rio Grande do Sul* and in the Dialysis Unit of the Moinhos de Vento Hospital. The project was submitted to and approved by the respective Ethics Research Committees (protocol CEP 03/06500) and all the participants provided written and informed consent before being enrolled in the study.

A total of 33 patients undergoing HD for more than three months, 18 years old or older, serum phosphorus = 6.0 md/dL, and with at least four years of formal education were included in the study. Amaurotic patients or with severe secondary hyperparathyroidism (PTH above 1000 pg/mL) were excluded.

Patients were randomly divided into two groups: Control (n=17) and Intervention (n=16). The Control group attended a course addressing vascular access, types of catheters and arteriovenous graft. The Intervention group attended a course instructing participants to avoid food rich in PO_4, the correct use of binders, the importance of serum levels of Ca, PO_4, Ca x PO_4 product, PTH, and manifestations of bone diseases. Each group attended six meetings with duration of 30 minutes immediately before consecutive sessions of HD, respecting the patients' routine in relation to scheduled dialysis days and time. To evaluate change of knowledge associated with the program, the same test was applied at the beginning and at the end of each module with 10 questions concerning vascular access and 10 concerning the metabolism of Ca and PO_4 in both groups. Each question was worth 10 points, totaling 100 points. A level of 80% of correct answers was arbitrarily determined as the minimum standard. This decision was motivated by the need, on the one hand, to ensure understanding of the entire content (100% of correct answers), and on the other hand, to acknowledge the potential impaired cognition of patients with CRF undergoing HD treatment. A loss of 20% of content seemed reasonable for the studied population[10].

Since adapting vocabulary to the cognitive level of individuals seems to be one of the main characteristics in the process of understanding ideas being presented, the Flesch Readability Index (Microsoft Word for Windows XP) was used to evaluate both the tests and content presented in each module of the program[11].

Visual educational tools such as images and drawings in addition to anatomic models and simulator mannequins were used in the program applied to each group. The modules were initiated with a message to sensitize the patients on the importance of self-care involving care with personal

and family health and the adoption of positive behavior in relation to their bodies. At the end of the modules, participants were sensitized to the importance of life.

The knowledge of the Control group patients concerning vascular access, different models of HD access, recognition of the functionality of access and identification of complications and understanding of the care necessary for good functioning was evaluated in the last phase of the program. The Intervention group patients were evaluated in relation to their ability to understand the importance of controlling serum phosphorus and calcium, identify signs and symptoms of hyperphosphatemia, recognize complications of hyperphosphatemia, and appropriately use medication and comply with the recommended diet.

Ca, PO_4, creatinine, urea and PTH were collected in the first week of each month and in the second HD session and were determined by an automatic biochemical method (Advia 1650, Bayer Healthcare, Tarrytown, NY, USA). The efficiency of dialysis was determined by measuring the normalized urea clearance (Kt/V) using Lowrie's formula[12]. The effectiveness of the program in changing the participants' behavior in relation to Ca and PO_4 was measured to compare levels of samples collected before the meetings and after 30, 60 and 90 days.

Categorical variables are presented as frequency and percentage; continuous variables and standard deviation (SD) or median and interquantile interval. Student's *t* test was used to compare continuous variables and Chi-square or Fischer's exact test for categorical variables. ANOVA repetitive measures were used to compare three or more matched continuous variables. The level of significance adopted was = 0.05. The Statistical Package for Social Sciences version 11.5 for Windows, SPSS Inc., Chicago, IL, EUA, was used in all statistical analysis.

RESULTS

Two patients quit the program, two were transplanted and four left due to other motives. The demographic and clinical characteristics of the individuals who completed the program are presented in Table 1.

Table 1 - Patients' demographic and clinical characteristics - Porto Alegre, RS, Brazil - 2007

Parameters	Control (n=17)	Intervention (n=16)
Gender (male)	8	10
Age (years)		
18-38	2	4
39-59	11	5
60-80	4	7
Level of alphabetization		
Functionally illiterate	3	2
Rudimentarily literate	7	2
Functionally literate	7	12
Time in dialysis (years)		
< 1	5	6
1-3	5	6
4-5	3	0
> 6	4	4
Underlying disease		
Hypertension	9	8
Diabetes Mellitus	3	1
Others	5	7

Note: (n=33)

The mean age was 52.5 (±14.2) years, with a slight prevalence of men (55%). The most frequent disease associated with CRF was hypertension (51.5%), followed by diabetic nephropathy (12%). The median time on dialysis was 19.9 (7.8-38.0) months.

Table 2 shows the results of knowledge tests concerning the addressed subjects in each group and the levels of Ca and PO_4 before and after the program. The levels of PO_4 were initially reduced in both groups; such a reduction was more prolonged in the Control group. However, significant differences between the groups in any of the parameters were not found at the end of the program. The average levels of PTH were high, though compatible with the level of renal function loss. The Kt/V was in agreement with technical recommendations[13].

Table 2 - Knowledge tests, biochemical exams and quality of dialysis – Porto Alegre, RS, Brazil - 2007

Parameter	Control (n = 17)		Intervention (n = 16)	
	Pretest	Posttest	Pretest	Posttest
Test of Ca and PO_4 (%)	80.1 ± 10.8	83.5 ± 14.1	71.2 ± 17.0	81.2 ± 23.0
Test of vascular access (%)	82.9 ± 16.4	91.7 ± 12.8	87.5 ± 10.6	88.7 ± 23.0
Ca (mg/dL)	9.0 ± 0.6	8.8 ± 1.3	9.2 ± 0.9	9.4 ± 1.0
Ca x PO_4 (mg/dL^2)	64.9 ± 1.5**	56.8 ± 16.3	67.4 ± 15.8†	64.2 ± 11.2
PO_4 (mg/dL)	7.3 ± 0.8**	6.5 ± 1.5	7.4 ± 1.9†	6.9 ± 1.3
PTH (pg/dL)	285 (123-578)	363 (131-710)	128 (91-282)	204 (84-507)
Kt/V	1.21 ± 0.17	1.30 ± 0.17	1.28 ± 0.40	1.32 ± 0.36

Note: (n=33)

Data were presented as mean ± standard deviation, or median (interquantile interval); Ca: calcium; PO_4: phosphorus; PTH: parathormone; Ca x PO_4: calcium phosphorus product; Kt/V: normalized urea clearance; †ANOVA repetitive measures ($P < 0.005$) *versus* posttest; **ANOVA repetitive measures ($P < 0.001$) *versus* posttest.

In the Control pretest, addressing Ca and PO_4, six subjects correctly answered < 80% of the questions and 11 ≥ 80%. In the posttest addressing the same subject, four correctly answered < 80% and 13 ≥ 80%. In the pretest addressing vascular access, five correctly answered < 80% of the questions and 12 ≥ 80%. In the posttest addressing the same subject, only two individuals correctly answered < 80%, while 15 individuals correctly answered ≥ 80% of the questions. The level of correct answers on the subject addressed by the program went from 29% to 71% while in the subject not addressed in the program, it went from 35% to 65%. In the pretest of the Intervention group addressing Ca and PO_4, eight individuals correctly answered both < 80% and ≥ 80% of questions. In the posttest addressing the same subject, two individuals correctly answered < 80% and 14 individuals ≥ 80%. In the posttest addressing vascular access, three correctly answered < 80% and 13 individuals ≥ 80% of questions. In the posttest addressing the same subject, one correctly answered < 80% and 15 individuals ≥ 80%. The level of correct answers concerning the subject addressed during the program went from 50% to 87.5% and correct answers on the subject not addressed by the program went from 81% to 93%.

DISCUSSION

This study evaluated, over a period of three months, the effect of an educational program addressing the control levels of Ca, PO_4, PTH and Ca x PO_4 product in CRF patients undergoing HD, with four or more years of education. The program did not result in significant differences of behavior between the selected groups, measured by biochemical markers.

The marked and lengthier fall of PO_4 levels and Ca x PO_4 product in the control group was an unexpected finding and contrary to the idea that originated the study: that the intervention group would display lower levels of biochemical markers compared to the Control group at the end of the program.

Many possibilities might explain this result: increased Kt/V induced by changing the area of the dialyzer, increased blood or dialysate flow, or the Control group spending more time in dialysis. Both groups experienced a gradual increase of Kt/V over the observation period, though this increase was not significant. Increased Kt/V was previously found in a nutritional educational program directed at patients undergoing HD[14].

Decreased PO_4 levels in the body are not immediately reflected in patients' clinical conditions and lacking this perception may hinder the patients' motivation to keep with the recommendations received over the educational program. This possibility has been suggested in the literature[15]. Even though the complications of bone disease in the long term were emphasized during the program, the patients apparently did not follow the recommendations, since the results of the laboratory exams did not change.

Contamination between groups, exchange of information in the period preceding the HD sessions cannot be excluded; participants of different groups may have exchanged information concerning content presented during meetings and complemented such information.

Another possibility that may explain the change of behavior through knowledge would be what Miller and Rollnick described as behavioral *stages* of acceptance of the disease and which influence changing of attitudes[16]. Patients undergoing HD and participating in a PO_4 control program tended to adhere in a fleeting manner to the treatment; they maintained adherence to it only during the intervention[17]. This result was similar to that of this study in which all patients in the intervention group kept appropriate levels of phosphorus only during the program's initial period.

A lack of individualized and continuous care might have negatively influenced biochemical markers. Hörl used an individual and flexible approach with his patients and concluded that this method is more efficacious[18]. Another study reduced levels of phosphorus when intensive and individualized care was applied[19]. In this study, the patients were considered apt after obtaining 100% of correct answers in the evaluation questionnaire; the educational meetings of 30 minutes were kept until they achieved this mark[19]. In this study, guidance was provided to small groups; teaching was not individualized.

There is experimental evidence that patients with higher levels of schooling and access to daily reading and internet have a better understanding of texts, at least in relation to free and informed consent forms[11]. Patients with higher schooling obtained better results both in the pretest and posttest though it did not result in significant differences in biochemical markers, suggesting that a potentially improved understanding of texts did not change their behavior. Difficulty in understanding texts in the program might have been a factor that influenced the lack of continuity in adherence even though the Flesch Reading index was used to classify the tests' level of difficulty and an audio-visual and playful approach was used to facilitate understanding. A systematic review of determinant factors of non-adherence to the PO_4 binders medication showed that social support and beliefs concerning health and family dynamics were the most important psychosocial predictors influencing adherence to medication; level of knowledge and duration of HD were not significant predictors. These data, in a certain way confirmed the findings of this study; it seems that the level of schooling did not influence level of adherence[20].

CONCLUSION

The maintenance of appropriate levels of PO_4 is a difficult goal to be achieved by patients. Even with the introduction of new drugs, a considerable number of CRF patients undergoing dialysis have average levels above that which is considered ideal, possibly due to a lack of adherence to medication and/or dietetic restrictions. Psychosocial factors such as family support and beliefs concerning health seem to be important determinants of therapy adherence. The implementation of a short-term educational program did not result in significant behavioral changes, measured through biochemical parameters. To be effective, educational programs aimed to change behavior and improve adherence to dietetic and pharmacological measures in CRF patients undergoing HD should probably be permanent. A multi-center and interdisciplinary study designed to determine the best approach to induce behavioral changes in high-risk and extremely heterogeneous populations is needed.

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