



IMPACT OF HEMODIALYSIS IN SERUM NITROGENOUS WASTE

IMPACTO DA HEMODIÁLISE NAS ESCÓRIAS NITROGENADAS SÉRICAS

IMPACTO DE LA HEMODIÁLISIS EN DESECHOS NITROGENADOS SÉRICOS

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ABSTRACT

Objectives: to describe the sociodemographic profile of patients on hemodialysis and analyze the pre/post-hemodialysis laboratory parameters. **Method:** this is a quantitative, descriptive and cross-sectional study with patients on hemodialysis. Data were collected using a sociodemographic form and documentary clipping of pre/post-hemodialysis laboratory examinations, examined by means of relative and absolute frequencies by the software Statistical Package of Social Sciences 21.0, as well as calculation of standard deviation and the reduction rate of metabolites. **Results:** of the 151 participants, 72.8% were men, 52.3% *pardos*, 74.4% Catholics, 37.8% were 40-59 years old, 33.8% had 4-8 years of schooling, 63.3% had 1-3 years of hemodialysis and 60.3% were admitted at the emergency. After hemodialysis, there was a reduction rate for urea, phosphorus, aluminum and glutamic-pyruvic transaminase. **Conclusion:** the profile of patients on hemodialysis consists of men, *pardos*, Catholics, 40-59 years old, 1-3 years of hemodialysis and from the emergency. The hemodialysis propitiated a significant reduction rate of nitrogenous waste. Educational activities focused on the patient's role in the prevention of complications stand out, in order to determine the treatment success. **Descriptors:** Adult Health; Health Care; Hemodialysis Hospital Units; Nephropathy; Chronic Disease; Renal Dialysis.

RESUMO

Objetivos: descrever o perfil sociodemográfico de pacientes em hemodiálise e analisar os parâmetros laboratoriais pré/pós-hemodiálise. **Método:** trata-se de estudo quantitativo, descritivo e transversal realizado com paciente em hemodiálise. Coletaram-se os dados através de formulário sociodemográfico e recorte documental de exames laboratoriais pré/pós-hemodiálise e analisou-os por meio de frequências relativas e absolutas pelo software *Statistical Package of Social Sciences* 21.0, bem como cálculo de desvio padrão e taxa de redução dos metabólitos. **Resultados:** identificou-se que de 151 participantes, 72,8% eram homens, 52,3% pardos, 74,4% católicos, 37,8% tinham entre 40-59 anos de idade, 33,8% possuíam 4-8 anos de escolaridade, 63,3% possuíam 1-3 anos de hemodiálise e 60,3% foram admitidos pela emergência. Após a hemodiálise, observou-se taxa de redução importante para a ureia, fósforo, alumínio e transaminase glutâmico-pirúvica. **Conclusão:** compõe-se o perfil de pacientes em hemodiálise homens, pardos, católicos, 40-59 anos, 1-3 anos de hemodiálise e provenientes da emergência. A hemodiálise propiciou taxa de redução significativa das escórias nitrogenadas. Ressalta-se a importância das atividades educativas voltadas para o protagonismo do paciente na prevenção de complicações, a fim de determinar o sucesso do tratamento. **Descritores:** Saúde do Adulto; Assistência à Saúde; Unidades Hospitalares de Hemodiálise; Nefropatia; Doença Crônica; Diálise Renal.

RESUMEN

Objetivos: describir el perfil sociodemográfico de los pacientes en hemodiálisis y analizar los parámetros de laboratorio pre/post-hemodiálisis. **Método:** se trata de un estudio cuantitativo, descriptivo y de corte transversal en pacientes en hemodiálisis. Se recogieron los datos mediante un formulario sociodemográfico y recorte documental de exámenes de laboratorio pre/post-hemodiálisis, examinados por medio de frecuencias absolutas y relativas por el software *Statistical Package of Social Sciences* 21.0, así como el cálculo de la desviación estándar y el coeficiente de reducción de metabolitos. **Resultados:** se encontró que de 151 participantes, el 72,8% eran hombres, 52,3% pardos, 74,4% católicos, 37,8% tenían entre 40-59 años de edad, 33,8% tenían 4-8 años de escolaridad, 63,3% tenían 1-3 años de hemodiálisis y 60,3% fueron admitidos por la emergencia. Después de la hemodiálisis, se observó una tasa de reducción significativa de urea, fósforo, aluminio y transaminasa glutámico pirúvica. **Conclusión:** el perfil de los pacientes en hemodiálisis es compuesto por hombres, pardos, católicos, 40-59 años de edad, 1-3 años de hemodiálisis y provenientes de la emergencia. La hemodiálisis propició la tasa de reducción significativa de los residuos nitrogenados. Se destaca la importancia de las actividades educativas centradas en el rol del paciente en la prevención de complicaciones, a fin de determinar el éxito del tratamiento. **Descriptores:** Salud del Adulto; Atención en Salud; Unidades Hospitalarias de Hemodiálisis; Nefropatía; Enfermedad Crónica; Diálisis Renal.

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INTRODUCTION

Chronic kidney disease (CKD) are lesions or structural changes in the kidneys, which leads to a reduced glomerular filtration rate to a value below 60 ml/min/1.73 m² for a period equal to or greater than three months.¹⁻² The reduction in filtration is much greater in Chronic Renal Failure (CRF), which can be below 15 ml/min/1.73m².³

CKD presents gradual, progressive and irreversible clinical course, so that, due to losses in the water and metabolic balance, individuals can become dependent on one of the therapeutic dialysis modalities to ensure their survival.³⁻⁴

The kidneys are essential for the conservation of body homeostasis, which occurs through glomerular filtration, production and secretion of hormones, such as erythropoietin, and enzymes, such as the 1.25-dihydroxyvitamin D and renin, among other functions, which do not occur as expected in patients with CRF, causing retention of metabolites that are toxic to the body, thus justifying the submission to a renal replacement therapy.³

Dialysis therapeutic modalities are currently the best options to replace kidney function when it is compromised, consequently enabling a prolonged life for patients with CRF, this way, there are three alternatives: hemodialysis, peritoneal dialysis and renal transplantation.^{2,5}

In Brazil, in 2016, 122,825 patients were undergoing dialysis, which represents a growth of 31.5 thousand patients in the last five years, i.e., 39,714 patients diagnosed with CRF began dialysis treatment in the studied year, corresponding to an incidence rate of 193 patients per million of the population.⁶

The most used therapeutic modality in Brazil is the conventional hemodialysis, representing 90% of dialysis treatments, according to the 2016 census of the Brazilian Society of Nephrology.⁶ This procedure is performed by means of a machine that operates in the extracorporeal filtration of blood, thus, one to four liters of fluid is removed from the patient, as well as toxic substances, for an average period of four hours, approximately three times per week.^{2,7}

A study aimed to describe the laboratory aspects of patients on hemodialysis, showing disagreement of results found with the standards of reference; however, there was no comparison between pre- and post-

hemodialysis results, which could allow inferring about the quality of the procedure.⁸

Given the increased numbers of cases of CRF and the increased use of hemodialysis as replacement therapeutic modality, the evaluation of the effectiveness of this treatment is of fundamental importance for the quality of care and greater patient survival, which underlies the completion of this study.

OBJECTIVES

- To describe the sociodemographic profile of patients on hemodialysis.
- To analyze the pre- and post-hemodialysis laboratory biochemical parameters.

METHOD

This is a quantitative epidemiological, descriptive and cross-sectional study, conducted at a satellite clinic of hemodialysis in high backcountry of Bahia, in the year 2016.

The participants in this study were patients diagnosed with CRF clinically stable and without any restriction of contact. There was exclusion of clinically unstable patients, who were not present in the days of data collection or who achieved a score lower than the cutoff value of the Mini Mental State Examination (MMSE), resulting in 151 patients.

The data were collected by means of a sociodemographic form that allowed characterizing the participants regarding gender, age, schooling, race/color, time of HD and form of admission, as well as a documentary clip that allowed extracting biochemical variables of laboratory examinations performed by patients before and after hemodialysis session.

Data were tabulated in the software Statistica Package of Social Sciences (SPSS) version 21.0 and analyzed by means of descriptive statistics, presentation of relative and absolute frequencies, as well as calculation of standard deviation and the rate of reduction of nitrogenous waste.

The Research Ethics Committee of the State University of Southwestern Bahia approved the study under opinion 972.480 and CAAE 53634016.6.0000.0055, in accordance with the determinations of resolution 466/12 of the National Health Council.

RESULTS

There was interview of 151 patients diagnosed with chronic renal failure and who obtained, in the MMSE, cutoff point of 13 and 32 points as minimum and maximum values,

respectively, with an average of 22.9 and standard deviation of 4.46. Table 1 shows the

sociodemographic characterization.

Table 1. Sociodemographic characterization of patients from a hemodialysis clinic of high backcountry of Bahia. Guanambi (BA), Brazil, 2016.

Variables		n	%
Gender			
	Male	110	72.8
	Female	41	27.2
Race/color			
	White	26	17.2
	Yellow/Asiatic	7	4.6
	Pardo	79	52.3
	Indigenous	3	2.0
	Black	32	21.2
	Unknown	4	2.7
Age group			
	20 - 39 years	16	10.6
	40 - 59 years	57	37.8
	60 - 79 years	49	32.4
	> 80 years	28	18.5
	Ignored	1	0.7
Schooling			
	Illiterate	35	23.2
	0 - 3 years	23	15.2
	4 - 8 years	51	33.8
	> 8 years	41	27.1
	Ignored	1	0.7
Religion			
	Catholic	117	77.4
	Non-Catholic	33	21.9
	Unknown	1	0.7
Hemodialysis (Time)			
	1 - 3 years	96	63.6
	4 - 6 years	31	20.5
	7 - 10 years	15	9.9
	> 10 years	9	6.0
Admission			
	Programmed	60	39.7
	Emergency	91	60.3

Table 2. Pre- and post-hemodialysis biochemical variables of patients. Guanambi (BA), Brazil, 2016.

	Pre-Hemodialysis		Post-Hemodialysis		
	Mean	SD	Mean	SD	%Reduction
Urea	143.5	60.5	43.6	16.1	69.6
Creatinine	8.5	4.2	8.4	6.6	1.1
Calcium	8.2	0.9	6.3	8.2	23.1
Phosphorus	9.0	51.6	4.7	3.3	47.7
Potassium	5.5	0.92	4.9	0.9	10.9
TGP	20.3	20	13.7	11.2	32.5
Red blood cells	3.84	84.9	2.96	22.1	22.9
Hemoglobin	9.41	7.56	9.1	2.4	3.29
Hematocrit	27.55	8.28	28.33	7.4	---
Leukocytes	6.813	5.39	6.432	2.67	5.59
Platelets	193.440	7.28	167.822	22.6	13.24
PTH	317.2	706.2	609.1	100.2	---
Aluminium	12.911.8	27.996.8	7.649.1	4.450.3	40.75
Cholesterol	163.8	59.2	198.2	110.1	---
HDL	38.1	20.5	40.8	25.7	---
LDL	101.2	53.1	91.1	37.8	9.9
Triglycerides	210.2	717.7	165.1	79.2	21.4

The quality of the offered hemodialysis is assessed through the urea removal index, understood by the formula Kt/V , whose average was 1.01 and standard deviation, 5.12. Regarding the laboratory data, mean values and standard deviations of the nitrogenous waste before and after hemodialysis are assessed, as well as the rate of reduction of these wastes after the procedure, which showed a significant reduction for some wastes. Table 2 shows the available variables.

DISCUSSION

There is similarity between the epidemiological data found and other studies, as well as the census conducted by the Brazilian Society of Nephrology, regarding the greater prevalence of male patients as well as the age range from 40 to 59 years of people undergoing hemodialysis.^{3,6,8}

The greater prevalence of men in the process of hemodialysis occurs by their lower frequency in health services, thus, the late diagnosis of a CKD leads to a poor prognosis.⁹

This therapy is performed in older adults once the greater the age, the higher the probability of being affected by chronic diseases such as diabetes mellitus and hypertension, which provides gradual onset of a CKD and consequently adherence to a treatment.^{2,10}

Other studies corroborate the results of this work, regarding race, in which *pardos* showed greater adherence to both hemodialysis, as well as to the pharmacological treatment.^{9,10} This result refers to the process of miscegenation present in the country, and consequently in health processes.¹¹

Other studies, in relation to schooling, identified from 4 to 8 years of study, and this low educational attainment hinders the treatment, since the degree of the patient's education influences the understanding about the disease and treatment, as well as the need for changing life habits.^{2,8,9}

Most participants self-reported Catholics, as well as in other studies, in terms of religion.^{8,12} This finding results from the fact that the country is predominantly Catholic, with 73.6% of the Brazilian population self-declared.¹¹

The time spent to perform hemodialysis could be described, as well as the form of admission to the treatment, in relation to the clinical characterization of patients. Regarding the time of hemodialysis, the result was similar to the literature, which records a

period of 1 through 3 years of treatment^{4,8,10}. Therefore, this period of treatment reflects the incidence of patients who needed initiating hemodialysis, as well as the high mortality after six years of therapy.¹⁰

Regarding the form of admission to the hemodialysis treatment, the emergency prevailed, and this variable was not discussed in other studies. Arterial hypertension and diabetes mellitus are the main causes of CKD in the country, which allows inferring that hemodialysis probably starts at the emergency due to low adherence of patients with chronic diseases to the program for the control of hypertension and diabetes in primary care, as well as the deficiency in coverage by the program, misconduct during the consultations or even difficulty by patients to adhere to drug treatment or adopt healthy life habits.^{1-2,6,9,13}

Several factors influence the quality of hemodialysis for the treatment of renal failure, such as care with the vascular access, responsible for the quality of the procedure, adherence to drug treatment and nutritional instructions that aim to reducing foods with a higher concentration of sodium, potassium, phosphorus, as well as the adequate intake of fluids and proteins.¹⁴

Furthermore, patients with renal impairment need to pay attention to the appropriate treatment, emphasizing the prevention of cardiovascular events, which prevents complications such as bone and mineral disorders, anemia and metabolic acidosis. Therefore, therapeutic interventions include control of hypertension, glycemic control, which relates to the risk of diabetic nephropathy in cases of hyperglycemia, dyslipidemia control, in addition to quitting smoking and controlling body weight.¹

The present study showed the quality of the hemodialysis process using the average value obtained for the fractional evaluation of urea (Kt/V), obtaining an inadequate result as well as observed in other studies.^{4,6,8} The adequate values for Kt/V are ≥ 1.4 and ≥ 1.2 , which refer to the target and minimum values respectively, and lower values are strongly associated with morbidity.¹⁵

Regarding biochemical parameters, the post-hemodialysis mean urea decreased significantly; however, the expected values after the procedure (15.5%) were not achieved, as well as shown in other studies.¹⁶⁻¹⁷

Urea is a toxic catabolic product from the ingestion of proteins, eliminated periodically of the body after the glomerular filtration;

however, in renal failure, it occurs through hemodialysis, retaining this waste until the next therapy session, which generates countless damage to the body.¹⁵ Moreover, the favoring of the alkalization of the salivary pH stands out.⁴

A study showed, in relation to the mean reduction of waste by gender, an average value significantly greater in male patients, suggesting a reduced ingestion of proteins by female gender.¹⁶

A study states that, although the evaluation of urea is a marker of the hemodialysis process quality, there is a low reference of this metabolite as a marker for the quality of the glomerular filtration, since, in addition to the return of a considerable portion of the same to plasma, there is interference of diet and the hepatic production at serum levels, in this sense, urea is used in conjunction with serum creatinine.¹⁷

The reduction rate of creatinine is irrelevant in this study. The analyzed averages were similar to the findings in the literature.¹⁶⁻¹⁷

Creatinine has been the most used marker of renal dysfunction in laboratory routine, whether by its sensitivity or by its specificity; however, the its serum amount presents interference related to body mass, since this product derives from creatine, present in the muscles, thus, its concentration also allows reflecting on the patient's nutritional improvement.¹⁷

A study identified the significant reduction in the average of urea and creatinine after nursing educational intervention. In view of this, once verified the factors that interfere in the nitrogenous parameters, patients should receive guidance for their greater adherence to treatment, which will impact on quality of life.¹⁸ In this context, the reduction of the serum concentration of these metabolites should not be restricted to the attainment of hemodialysis.

In this study, most of the nitrogenous waste reduced significantly, following the example of the phosphorus (P) and calcium (CA), which showed a reduction of 47.7% and 23.1% respectively after hemodialysis, which shows a positive result, because the maintenance of adequate levels of these substances in the body is a difficult process for patients with CKD. Furthermore, their increase is intimately associated with negative prognosis and increased mortality related to cardiovascular events.¹⁹

The potassium (K) was also assessed, which presented a more discreet reduction in relation to the previous values; however, the

reduction of these levels through hemodialysis contributes to the prevention of injuries such as hyperkalemia that can generate serious arrhythmias and even cardiac arrests.²⁰

There was no reduction of the levels of parathyroid hormone (PTH); on the contrary, the levels had a mean variation of 317.2 to 609.1 after hemodialysis, and the value recommended by the Ministry of Health is 600ng/dl, which is explained by the fact that the release of parathyroid hormone correlates inversely with the levels of Ca, thus, the differences in the balance of Ca and P in the body influence the function of this gland.^{21,22}

The level of concentration of aluminum reduced significantly, a metal easily found in nature and which offers several toxic effects to humans, especially in patients with renal deficit, which hinders its excretion and that consequently provides its accumulation in the brain, bones, parathyroid glands, among others. Its symptoms are observed from the affected organ, concentration and intensity of intoxication; however, the most common manifestations are hypochromic anemia, acute neurotoxicity and dialysis encephalopathy.²³⁻⁴

Aluminum poisoning is prevented in patients with chronic renal disease through the non-use of aluminum-based phosphorus in hemodialysis, as well as in the semiannual monitoring of the concentration of aluminum in the water of the dialysed patient, which must be below 5 µg/l. In cases of intoxication by this metal, there should be an early diagnosis of intoxication, which consists of performing the deferoxamine test, and its treatment is based on the same, respecting the values of: 5mg/kg diluted in 100 ml of saline solution at 0.9% or 5% glucose in intravenous route during half an hour after finishing the first hemodialysis session of the week.²³

The parameters of the hematological variables reduced, which generally refers to the onset of anemia, a frequent clinical manifestation among patients with CKD undergoing hemodialysis, which intensifies over the course of the decrease in renal function.²⁵

The deficit of erythropoietin, as well as metabolic disorders, which contributes to the deficiency of iron, are the main causes of anemia in hemodialysis patients.²⁵⁻⁶

There was also anemia resulting from the decreased amount of red blood cells, in addition to the reduced level of hematocrit, whose recommended values are between 39 and 53% in men and 35 and 47% in women.¹⁷ From this perspective, a study showed a

reduced severity of anemia, as well as increased hematocrit from the introduction of EPO and/or iron during the process of hemodialysis.¹⁷

The values found for the averages for hemoglobin were incompatible with the recommendations of the Brazilian Society of Nephrology, which are ≥ 12 g/dl for men and ≥ 11 g/dl for women.^{17,25}

An observational study showed that hemoglobin levels below 11 g/dl could be associated to cardiovascular events, increased cases of hospitalizations, decreased quality of life of patients with the disease and mortality; however, high levels of hemoglobin can increase the chance of complications such as hypertension, thrombolism and death, which justifies the need for constant laboratory monitoring of hematological biochemical variables of patients with CKD.²⁶

A limitation of this study was its population, which, due to the reduced number that considered the collection in just a hemodialysis satellite clinic, does not allow expanding the results for other populations.

CONCLUSION

The profile of patients with chronic renal failure on hemodialysis consists predominantly of men, brown, aged from 40 to 59 years, low schooling and Catholics. Furthermore, they have little time in hemodialysis treatment and admission recorded by means of emergency, which allows inferring the carelessness related to health care, which generates incidence of individuals with CKD on hemodialysis and reflects on their mortality.

Hemodialysis is a fundamental process in the survival of patients with renal disorders, since it provides a significant rate of reduction of nitrogenous waste accumulated in the body; however, hardly reaching ideal values. In this perspective, there is the need for frequent monitoring of laboratory examinations of patients on hemodialysis, in order to evaluate the quality of the treatment, as well as to allow tracing individual and appropriate care plans for each individual.

Moreover, educational activities focused on these patients are extremely important, since their role in the prevention of complications can determine the success of the treatment and guarantee survival and well-being of the users.

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