

COMPLICATIONS IN PATIENTS WITH CHRONIC RENAL FAILURE UNDERGOING HEMODIALYSIS*

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ABSTRACT: The present study aimed to identify complications in patients with chronic renal failure undergoing hemodialysis and correlate them to socio-demographic and clinical factors. Cross-sectional study with 200 patients conducted in a nephrology clinic in the Northeast of Brazil. Data was collected in March and April 2015 through a structure questionnaire completed by the participants. Chi-square and Fisher's Exact tests were performed in inferential analysis, and Mann-Whitney U test was used to assess the relationship between categorical (nominal) and numerical variables. The statistically significant associations were hypotension with age, gender and interdialytic weight gain; chills with gender and interdialytic weight gain; vomiting with gender, dialysis site and Kt/V; headache with gender and age; dizziness with years of schooling, religious belief and interdialytic weight gain; arrhythmia and age; diarrhea and length of time on dialysis treatment; abdominal pain and interdialytic weight gain; sweating and age. It is concluded that complications during hemodialysis can be affected by socio-demographic and clinical factors.

DESCRIPTORS: Nursing; Renal dialysis; Complications; Renal failure; Health profile.

COMPLICAÇÕES EM PACIENTES RENAI CRÔNICOS SUBMETIDOS À HEMODIÁLISE

RESUMO: Objetivou identificar as complicações em pacientes renais crônicos submetidos à hemodiálise e correlacioná-las aos fatores sociodemográficos e clínicos. Estudo transversal, com 200 pacientes em uma clínica de nefrologia no Nordeste do Brasil. Utilizou-se um formulário para a coleta de dados, que ocorreu durante março e abril de 2015. Na análise inferencial, foram aplicados testes de Qui-Quadrado e Exato de Fisher, e U de Mann-Whitney, na associação entre variáveis nominais e numéricas. As associações estatísticas foram: hipotensão com idade, sexo e ganho de peso interdialítico; calafrios com sexo e ganho de peso interdialítico; vômito com sexo, sítio de diálise e KT/V; cefaleia com sexo e idade; tontura com anos de estudo, religião e ganho de peso interdialítico; arritmia e idade; diarreia e tempo de hemodiálise; dor abdominal e ganho de peso interdialítico; sudorese e idade. Conclui-se que complicações durante a hemodiálise podem sofrer influência de fatores sociodemográficos e clínicos.

DESCRIPTORIOS: Enfermagem; Diálise renal; Complicações; Insuficiência renal; Perfil de saúde.

COMPLICACIONES EN PACIENTES RENALES CRÓNICOS SOMETIDOS A HEMODIÁLISIS

RESUMEN: Se objetivó identificar complicaciones en pacientes renales crónicos sometidos a hemodiálisis y correlacionarlos a factores sociodemográficos y clínicos. Estudio transversal, con 200 pacientes en clínica de nefrología del Nordeste de Brasil. Se aplicó formulario para recolección de datos, realizada durante marzo y abril de 2015. Para análisis inferencial fueron aplicados tests de Chi-cuadrado y Exacto de Fisher, y U de Mann-Whitney para asociación entre variables nominales y numéricas. Las asociaciones estadísticas fueron: hipotensión con edad, sexo e incremento de peso interdialítico; escalofríos con sexo e incremento de peso interdialítico; vómitos con sexo, sitio de la diálisis y KT/V; cefalea con sexo e edad; mareos con años de escolarización, religión e incremento de peso interdialítico; arritmia y edad; diarreia y tiempo de hemodiálisis; dolor abdominal e incremento de peso interdialítico; sudoración y edad. Se concluye en que las complicaciones durante la hemodiálisis pueden resultar influidas por factores sociodemográficos y clínicos.

DESCRIPTORIOS: Enfermería; Diálisis Renal; Complicaciones; Insuficiencia Renal; Perfil de Salud.

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● INTRODUCTION

End Stage Renal Disease (ESRD) is characterized by progressive and irreversible loss of renal functions, resulting in severe metabolic disorders⁽¹⁾. Hemodialysis (HD) is the most common renal replacement therapy in the world, as well as in Brazil, where 90% of the patients with ESRD undergo dialysis⁽²⁾.

Despite its benefits to patients, HD involves several complications related to the elimination of uremic solutes, water and electrolytes, to the patient's response and to dialysis. These complications increase the morbidity and mortality of renal patients on hemodialysis⁽³⁻⁴⁾.

According to the literature⁽⁵⁻⁶⁾ the main complications are muscle cramp, pruritus and headache. Also, complications with lower prevalence include abdominal pain, hypotension, hypertension, vomiting, short-term weight gain and constipation⁽⁶⁾.

Since the literature shows different prevalence rates of the main complications, the incidence of these complications must be accurately measured, taking into consideration the context of the patients. Thus, further studies should be developed to identify the prevalence of these complications, as well as to relate them to socio-demographic and clinical factors.

Moreover, it is necessary to relate the complications to the socio-demographic and clinical characteristics of the patients, which implies a greater participation of the health professionals, especially nurses, in this process. Based on these elements, the nursing staff will consider the patient's social aspects in the planning of care and preventive measures. Some authors⁽⁷⁾ stress the importance of such approach, as it allows the allocation of health care services to the most vulnerable clients, contributing to a better quality of life and lower hospital costs.

Therefore, the following questions were posed: What are the complications faced by patients with chronic renal failure undergoing hemodialysis? Are these complications influenced by socio-demographic and clinical factors? Based on these questions, the present study aims to identify complications patients with chronic renal failure undergoing hemodialysis and correlate them with socio-demographic and clinical factors.

● METHOD

Cross-sectional study conducted at a nephrology reference clinic in the Northeastern region of Brazil. Convenience sampling was used, with the participants consecutively selected in order of appearance, in the months of March and April 2015.

The population was composed of 300 patients undergoing hemodialysis treatment at the referred clinic. Sample calculation was based on the sample size equation for determination of finite populations, considering a 95% confidence level ($Z\alpha = 1.96$), sample error of 5%, a population of 300 patients and the conservative value of 50% of prevalence. A sample of 168 patients was obtained, which was rounded to 200 individuals.

The inclusion criteria were as follows: patients aged 18 years or over, undergoing dialysis in the referred dialysis unit. The exclusion criteria were individuals with difficult verbal communication that made data collection impossible and patients disoriented in time and space.

A structured questionnaire with questions about socio-demographic and clinical data and the complications experienced by the patients during hemodialysis was used as a data collection instrument. The questionnaire was submitted to validation of content and appearance by six nurses with nephrology nursing practice. The suggestions made by these professionals were incorporated into the final questionnaire.

In the pre-testing stage, 20 patients with chronic renal failure undergoing hemodialysis. completed the structured questionnaire. There was no need for cultural adaptation of the tool. Thus, the patients who participated in the pre-testing stage were included in the study sample.

The data was collected by previously trained researchers, who conducted the interviews with the patients who were undergoing dialysis.

A database was created for recording socio-demographic and clinical data, as well as the identified complications. For data analysis, the statistical software IBM SPSS Statistic® was used to generate absolute and relative frequencies, as well as measures of central tendency and dispersion. Normality was identified by the Kolmogorov-Smirnov test. For inferential analysis and association between the nominal variables, Chi-Square and Fisher's Exact tests were performed, and Mann-Whitney U test was used to assess the relationship between categorical and numerical variables. The level of significance was 5% ($p < 0.05$).

The study was approved by the Research Ethics Committee of the nephrology clinic where it was conducted, under no 387.837.

● RESULTS

Of the total number of patients interviewed, 102 (51%) were female; 107 (53.5%) lived with a partner; 173 (86.5%) had religious beliefs; 108 (54%) lived in the inland of the state and were in average 55 years old. They had completed in average 8.69 years of schooling, and the family income was 3.76 minimum wages.

Regarding clinical data, the time elapsed since diagnosis of chronic renal failure was 7.9 years and the patients have been undergoing hemodialysis for 5.6 years. Arteriovenous fistula (AVF) was the venous access for hemodialysis in 150 (75%) of the patients interviewed. The participants had a mean interdialytic weight gain of 1.92 kg and Kt/V (method that assesses adequacy of dialysis) of 1.21.

The main complications reported by the patients during hemodialysis were cramps (149; 74.5%), hypotension (141; 70.5%), chills (104; 52%), vomiting (77; 38.5%), headache (71; 35.5%), dizziness (70; 35%), hypertension (48; 24%) and arrhythmia (40; 20%). Complications such as nausea, convulsions, diarrhea and abdominal pain were frequent in only two patients (1%) of the sample. Sleepiness, mental distress, sweating, weakness, shortness of breath, numbness, body aches and tremors accounted for 0.5% of complications.

Table 1 shows the association between the complications of patients with chronic renal failure during hemodialysis and socio-demographic/clinical data.

Table 1 – Analysis of the association between socio-demographic and clinical data and complications during hemodialysis in chronic renal patients. Natal, RN, Brazil, 2017 (continues)

Complications	Gender	Age	Marital Status	Income	Schooling	Origin	Religion	Time CRF†	Time HD	Site Dialysis	Weight gain	KT V
Cramp	0.748§	0.210¥	0.926§	0.912¥	0.653¥	0.635§	0.371§	0.416¥	0.806¥	0.124§	0.128¥	0.343¥
Hypotension	0.028§*	0.014¥*	0.09§	0.098¥	0.054¥	0.374§	0.661§	0.732¥	0.832¥	0.495§	0.001¥*	0.063¥
Chills	0.046§*	0.148¥	0.856§	0.932¥	0.630¥	0.276§	0.667§	0.714¥	0.684¥	0.393§	0.026¥*	0.586¥
Vomiting	0.005§*	0.720¥	0.955§	0.479¥	0.185¥	0.114§	0.495§	0.055¥	0.300¥	0.043§*	0.129¥	0.020¥*
Headache	0.021§*	0.003¥*	0.770§	0.178¥	0.401¥	0.691§	0.541§	0.116¥	0.357¥	0.420§	0.766¥	0.361¥
Dizziness	0.202§	0.787¥	0.466§	0.426¥	0.018¥*	0.963§	0.048§*	0.520¥	0.786¥	0.112§	0.049¥*	0.356¥
HA‡	0.249§	0.5913	0.577§	0.860¥	0.378¥	0.760§	0.473§	0.496¥	0.625¥	0.617§	0.064¥	0.431¥
Arrhythmia	0.203§	0.012¥*	0.887§	0.909¥	0.834¥	0.395§	0.756§	0.618¥	0.191¥	0.278§	0.762¥	0.937¥
Nausea	0.741¶¶	0.109¥	0.715¶¶	0.814¥	0.256¥	0.710¶¶	0.252¶¶	0.476¥	0.985¥	0.584¶¶	0.661¥	0.166¥
Convulsions	0.741¶¶	0.743¥	0.715¶¶	0.356¥	0.153¥	0.290¶¶	0.748¶¶	0.476¥	0.418¥	0.416¶¶	0.204¥	0.519¥
Diarrhea	0.259¶¶	0.444¥	0.715¶¶	0.399¥	0.514¥	0.290¶¶	0.748¶¶	0.642¥	0.003¥*	0.054¶¶	0.073¥	0.519¥
Abdominal pain	0.259¶¶	0.472¥	0.715¶¶	0.946¥	0.604¥	0.710¶¶	0.748¶¶	0.955¥	0.227¥	0.054¶¶	0.009¥*	0.618¥
Sleepiness	0.510¶¶	0.360¥	0.535¶¶	0.350¥	0.520¥	0.540¶¶	0.865¶¶	0.633¥	0.580¥	0.765¶¶	0.890¥	0.221¥

Mental distress	0.510¶	0.06¥	0.465¶	0.920¥	0.100¥	0.540¶	0.865¶	0.633¥	0.790¥	0.765¶	0.890¥	0.784¥
Sweating	0.490¶	0.020¥	0.465¶	0.520¥	0.770¥	0.540¶	0.135¶	0.503¥	0.440¥	0.235¶	0.890¥	0.221¥
Weakness	0.510¶	0.790¥	0.535¶	0.520¥	0.550¥	0.460¶	0.865¶	0.503¥	0.580¥	0.765¶	0.100¥	0.784¥
Shortness of breath	0.490¶	0.740¥	0.535¶	0.350¥	0.770¥	0.540¶	0.865¶	0.191¥	0.090¥	0.235¶	0.890¥	0.784¥
Numbness	0.510¶	0.390¥	0.535¶	0.520¥	0.840¥	0.540¶	0.865¶	0.683¥	0.930¥	0.765¶	0.890¥	0.784¥
Pain	0.510¶	0.110¥	0.465¶	0.180¥	0.120¥	0.540¶	0.865¶	0.181¥	0.790¥	0.765¶	0.450¥	0.784¥
Tremors	0.510¶	0.090¥	0.465¶	0.400¥	0.550¥	0.460¶	0.865¶	0.081¥	0.080¥	0.235¶	0.890¥	0.784¥

Legend: †CRF – Chronic Renal Failure; ‡AH– Arterial Hypertension; §Chi-Square Test; ¶Fisher's exact test; ¥ Mann-Whitney U test *Variables with statistically significant association.

Complications and socio-demographic factors that showed statistically significant associations were hypotension and age ($p = 0.028$), hypotension and gender ($p = 0.014$), hypotension and interdialytic weight gain ($p = 0.001$), chills and gender ($p = 0.046$), chills and interdialytic weight gain ($p = 0.026$); vomiting and dialysis site ($p = 0.043$), vomiting and Kt / V ($p = 0.020$); headache and gender ($p = 0.021$), headache and age ($p = 0.003$); dizziness and years of schooling ($p = 0.018$), dizziness and religion ($p = 0.048$), dizziness and interdialytic weight gain ($p = 0.049$); arrhythmia and age ($p = 0.012$); diarrhea and number of years patients have been undergoing dialysis ($p = 0.003$); abdominal pain and interdialytic weight gain ($p = 0.009$); and sweating and age ($p = 0.020$).

● DISCUSSION

Complications related to ESRD and hemodialysis are important factors to be monitored and prevented, since, depending on their intensity, they can lead to serious consequences and reduce the quality of life of patients with ESRD⁽⁸⁾.

Hypotension was a frequent complication in the study population, contrasting with the literature⁽⁶⁾, where it is addressed as a secondary complication. This is a compensatory cardiovascular response during dialysis that occurs when ultrafiltration rate exceeds the refilling rate⁽⁹⁾. The rapid removal of osmotically active substances and the delayed balance in intracellular compartments cause temporary decrease in plasma osmolality, justifying hypotension episodes⁽¹⁰⁾.

This complication was associated with age, gender and interdialytic weight gain in renal patients. One study⁽¹¹⁾ describes hypotension as one of the main acute complications during hemodialysis, identifying its prevalence in 50% of the female patients with an average age of 47 years and undergoing hemodialysis, corroborating the data of the present study⁽¹¹⁾. As for weight gain, patients with excess fluid are more prone to lower blood pressure due to greater removal of fluid and electrolytes during the sessions, especially if the volume of ultrafiltration is rapid or excessive⁽¹²⁾.

In this regard, patients undergoing dialysis, especially female adults who experienced weight gain in a short period of time, reflect the increased vulnerability for complications such as hypotension. The identified associations reflect the need for nurses to promote health education, providing guidance to patients on the observation of the prescribed diet, especially those with the aforementioned characteristics, in order to avoid such complication.

Chills are generally associated with vascular access infections related to pyrogenic reactions, disinfection of the hemodialysis machine and water treatment⁽¹⁰⁾. One study reports the occurrence of chills related to infection in 60% of the respondents, recommending the beginning of antibiotic use since the first episode of this complication⁽¹³⁾.

Chills showed a statistically significant association with the variables gender and interdialytic weight gain, and female gender prevailed among the participants. Corroborating the relationship of this complication with gender, a study revealed the occurrence of chills, especially in female patients⁽¹⁴⁾.

Chills are associated with musculoskeletal changes in patients submitted to hemodialysis, especially in women⁽¹¹⁾.

No studies demonstrating direct association between chills and interdialytic weight gain were identified. However, one study has shown that this clinical data accounts for many of the complications during the hemodialysis session⁽¹⁴⁾. Therefore, female patients with interdialytic weight gain are more vulnerable to chills, and it is necessary to promote effective interventions in order to avoid the occurrence of the referred complication, which has strong impact on quality of life of dialytic patients.

Vomiting had a statistically significant association with gender, dialysis site and Kt/V. Episodes of vomiting during hemodialysis have multiple causes, such as increased dialysate sodium and calcium concentrations and gastroparesis⁽¹⁰⁾. Vomiting was more severe in women⁽¹⁵⁾.

Regarding the association between vomiting and Kt /V, no studies demonstrating this association were found. However, we stress the importance of maintaining hemodialysis at appropriate levels in accordance with the guidelines of the National Kidney Foundation Disease Outcomes Quality Initiative, which recommend a Kt/V value higher than 1.2 to reduce the occurrence of complications during the sessions⁽¹⁶⁾.

Headache was also cited as a complication observed during dialysis, with a statistically significant association with the variables gender and age. This complication was reported by some authors as one of the most frequent among patients on dialysis⁽¹⁰⁾. Headache can be caused by the stress faced by patients undergoing dialysis and is related to the decrease in magnesium levels and increase of sodium levels in the pre- and post-dialysis periods⁽¹⁷⁾.

Regarding gender, the literature⁽¹⁸⁾ shows that headache occurs predominantly in males, not corroborating the association found in the present study. Regarding the association with age, another study cited headache as one of the main complications of hemodialysis in older patients⁽¹⁹⁾.

Despite divergent data, other studies mentioned pain, especially headache, as an important acute complication in hemodialysis, especially in females, since women are more vulnerable to painful musculoskeletal disorders. It should be stressed that pain perception varies among individuals, and involves many factors. Thus, a holistic, comprehensive assessment of the pain of patients undergoing hemodialysis, especially women, is necessary⁽¹¹⁾.

Dizziness showed a statistically significant association with the number of years of schooling, religious belief and interdialytic weight gain. Dizziness is related to episodes of hypotension caused by fluid intake restrictions during the procedure, especially when there is excessive increase in weight between the sessions⁽²⁰⁾.

A study with hemodialysis patients showed that 74.3% (n = 26) of the respondents had not concluded elementary school⁽²¹⁾, which made it difficult for these patients to understand the information related to the disease and treatment. This was a preponderant factor for reducing adherence to treatment⁽⁷⁾.

Religion was included as a relevant socio-demographic characteristic because patients in dialysis with religious beliefs had a better quality of life compared to those who did not have religious beliefs⁽²²⁾. On the other hand, another study⁽²³⁾ that investigated the religious beliefs of people undergoing hemodialysis found that less religious patients were more likely to adhere to treatment. This was explained by the fact that individuals who have religious beliefs may think that religion protects them against diseases and discontinue treatment⁽²³⁾, which would explain the association found in the present study between religion and dizziness.

Arrhythmia was another complication in these patients, and showed a statistically significant association with age. A study showed that heart problems are common in patients in dialysis due to the significant changes in electrolyte levels related to cardiac activity. These changes may affect the repolarization process⁽²⁴⁾. Regarding age, a study showed that older individuals with ESRD were more likely to develop arrhythmias⁽²⁵⁾.

Diarrhea showed a statistically significant association with the length of time over which the patient has been undergoing hemodialysis. This complication may reflect the worsening of nutritional status, impairing the absorption of food⁽²⁶⁾. Due to immunosuppression, hemodialysis patients are susceptible

to infections, including gastrointestinal infections. Studies also report a statistically significant association between the length of time on dialysis treatment and the presence of diarrhea in these patients ⁽²⁶⁻²⁷⁾.

Therefore, abdominal pain was also present and was associated with interdialytic weight gain. Interdialytic overweight requires further removal of fluid during hemodialysis, which culminates in acute consequences during the procedure that involves most fluid restriction.

In this regard, the literature focuses on changes in the nutritional status of patients with interdialytic weight gain, especially those who have been undergoing dialysis for longer periods, indicating the need to assess the socio-demographic and clinical aspects of each patient in relation to abdominal complications, regulating interdialytic weight ⁽²⁸⁾.

Thus, the interventions designed for patients with who have been undergoing hemodialysis for longer time, as well as for those who showed excessive weight gain in a short period, should reduce the vulnerability of these patients to abdominal disorders such as diarrhea and abdominal pain.

Sweating is described in the literature as a complication occurring during dialysis ⁽²⁹⁾. In the present study, it showed a statistically significant association with age. The literature emphasizes the need for a more accurate measurement of sweat fluid in hemodialysis patients, citing microvasculopathy as a complication related to the duration of hemodialysis sessions, which affects sweating and reabsorption of water. Moreover, the fluid volume of sweat varies depending upon age, i.e., it is greater in patients older than 50 years ⁽³⁰⁾.

The associations demonstrated in this study can help health professionals in the early identification of complications during hemodialysis, as well as in the recognition of the socio-demographic and clinical factors that favor their occurrence, assisting them in the adoption of the appropriate actions to reduce risks and, consequently, the complication itself, improving the quality of life of these patients.

The socio-demographic variables marital status, income, and origin, as well as the clinical variable time elapsed since diagnosis of CRF did not show a statistically significant association with the complications experienced during the hemodialysis procedure. However, these variables were essential for patient characterization.

One limitation of this study was the fact that complications were identified only in patients undergoing hemodialysis, not including other therapies for renal function replacement. Longitudinal studies are recommended to prove the associations found in the present study.

● CONCLUSION

It is concluded that the complications experienced by renal patients undergoing hemodialysis may be influenced by socio-demographic and clinical aspects of the patients. The statistically significant associations identified were hypotension with age, gender and interdialytic weight gain; chills with gender and interdialytic weight gain; vomiting with gender, dialysis site and Kt/V; headache with gender and age; dizziness with years of schooling, religious belief and interdialytic weight gain; arrhythmia and age; diarrhea and length of time on dialysis treatment; abdominal pain and interdialytic weight gain.

The findings of the present study contribute to the planning and execution of care to patients on dialysis, resulting in actions based on the social and clinical aspects experienced. The understanding of these aspects contributes to health actions able to overcome complications during the hemodialysis procedure, as well as for the early identification of the vulnerability of these patients.

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REFERENCES

1. National Kidney Foundation (KDIGO). Kidney disease improving global outcomes. *Am. J. Kidney Dis.* [Internet] 2013;3(1) [acesso em 14 jan 2017]. Disponível: <https://www.theisn.org/kidney-disease-improving-global-outcomes-kdigo>.
2. Sesso RCC, Lopes AA, Thomé FS, Lugon JR, Watanabe Y, dos Santos DR. Diálise Crônica no Brasil: Relatório do Censo Brasileiro de Diálise, 2011. *J Bras Nefrol.* [Internet] 2012;34(3) [acesso em 14 jan 2017]. Disponível: <http://dx.doi.org/10.5935/0101-2800.20120009>.
3. Mehmood Y, Ghafoor S, Ashraf MI, Riaz H, Atif SR, Saeed M. Intradialytic complications found in patients at a tertiary care hospital. *Austin J Pharmacol Ther.* [Internet] 2016;4(1) [acesso em 10 mar 2017]. Disponível: <http://austinpublishinggroup.com/pharmacology-therapeutics/fulltext/ajpt-v4-id1079.php>.
4. Inrig JK, Molina C, D'Silva K, Kim C, Van Buren P, Allen JD, et al. Effect of low versus high dialysate sodium concentration on blood pressure and endothelial-derived vasoregulators during hemodialysis: a randomized crossover study. *Am J Kidney Dis.* [Internet] 2015;65(3) [acesso em 10 mar 2017]. Disponível: <http://dx.doi.org/10.1053/j.ajkd.2014.10.021>.
5. Goudarzian AH, Nia HS, Okamoto Y, Rhee CM, McFarlane P, Nejad FG. Adverse effects of hemodialysis on kidney patients: how good the evidence is. *Int J MedInvest.* [Internet] 2015;4(4) [acesso em 21 mar 2017]. Disponível: http://www.intjmi.com/browse.php?a_code=A-10-1-120&slc_lang=en&sid=1.
6. Coitinho D, Benetti ERR, Ubessi LD, Barbosa DA, Kirchner RM, Guido LA, et al. Intercorrências em hemodiálise e avaliação da saúde de pacientes renais crônicos. *Av Enferm.* [Internet] 2015;33(3) [acesso em 21 mar 2017]. Disponível <http://dx.doi.org/10.15446/av.enferm.v33n3.38016>.
7. Frazão CMFQ, Sá JDS, Paiva MGMN, Lira ALBC, Lopes MVO, Enders BC. Association Between Nursing Diagnoses and Socioeconomic/Clinical Characteristics of Patients on Hemodialysis. *Int J Nurs Knowl.* [Internet] 2015;26(3) [acesso em 4 dez 2016]. Disponível: <http://dx.doi.org/10.1111/2047-3095.12051>.
8. Kraus MA, Fluck JF, Weinhandl ED, Kansal S, Copland M, Komenda P, et al. A. Intensive hemodialysis and health-related quality of life. *Am J Kidney Dis.* [Internet] 2016;68(5) [acesso em 15 fev 2016]. Disponível: <http://dx.doi.org/10.1053/j.ajkd.2016.05.023>.
9. Gil HW, Bang K, Lee SY, Han BG, Kim JK, Kim YO, et al. Efficacy of Hemocontrol biofeedback system in intradialytic hypotension-prone hemodialysis patients. *J. Korean Med. Sci.* [Internet] 2014;29(6) [acesso em 15 jan 2016]. Disponível: <http://dx.doi.org/10.3346/jkms.2014.29.6.805>.
10. Prabhakar SRG, Singh S, Rathore SS, Choudhary TA. Spectrum of intradialytic complications during hemodialysis and its management: A single-center experience. *Saudi J Kidney Dis Transpl.* [Internet] 2015;26(1) [acesso em 9 dez 2016]. Disponível: <http://www.sjkdt.org/article.asp?issn=1319-2442;year=2015;volume=26;issue=1;spage=168;epage=172;aulast=Prabhakar%2C>.
11. Atik D, Karatepe H, Karatepe C, Demir S, Çınar S, Sökmen S. The effect of gender on the complications, pain intensity and pain management in hemodialysis patients. *Int J Res Med Sci.* [Internet] 2016;4(5) [acesso em 06 set 2017]. Disponível: <http://www.scopemed.org/?mno=219666>.
12. Morfin JA, Fluck RJ, Weinhandl ED, Kansal S, McCullough PA, Komenda P. Intensive Hemodialysis and Treatment Complications and Tolerability. *Am J Kidney Dis.* [Internet] 2016;68(5 Suppl 1) [acesso em 15 fev 2016]. Disponível: <http://dx.doi.org/10.1053/j.ajkd.2016.05.021>.
13. Shepshelovich D, Yelin D, Bach LO, Halevy N, Ziv Y, Green H, et al. Chills during hemodialysis: prediction and prevalence of bacterial infections – a retrospective cohort study. *Am J Med.* [Internet] 2017;130(4) [acesso em 10 mar 2017]. Disponível: <http://dx.doi.org/10.1016/j.amjmed.2016.11.022>.
14. de Oliveira APC, de Sousa AS, de Mendonça AEO, da Silva RAR. Intradialytic complications in patients with chronic renal failure submitted to hemodialysis: integrative review. *Rev enferm UFPE online.* [Internet] 2013;7(11) [acesso em 14 jan 2016]. Disponível: <http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/viewArticle/2547>.

15. Asgari MR, Asghari F, Ghods AA, Ghorbani R, Motlagh NH, Rahaei F. Incidence and severity of nausea and vomiting in a group of maintenance hemodialysis patients. *JRIP* [Internet] 2017;6(1) [acesso em 10 mar 2017]. Disponível: <http://dx.doi.org/10.15171/jrip.2017.09>.
16. National Kidney Foundation (KDOQI). Clinical practice guideline for hemodialysis adequacy: 2015 update. *Am J Kidney Dis.* [Internet] 2015;66(5) [acesso em 06 set 2017]. Disponível: <http://dx.doi.org/10.1053/j.ajkd.2015.07.015>.
17. Levin M. Resident and Fellow Section. Headache. [Internet] 2009;49(6) [acesso em 4 dez 2016]. Disponível: <http://dx.doi.org/10.1111/j.1526-4610.2009.01442.x>
18. Stojimirovic B, Milinkovic M, Zidverc-Trajkovic J, Trbojevic-Stankovic J, Maric I, Milic M, et al. Dialysis headache in patients undergoing peritoneal dialysis and hemodialysis. *Ren Fail.* [Internet] 2015;37(2) [acesso em 10 dez 2016]. Disponível: <http://dx.doi.org/10.3109/0886022X.2014.982486>.
19. Lakshman SG, Ravikumar P, Kar G, Das D, Bhattacharjee K, Bhattacharjee P. A comparative study of neurological complications in chronic kidney disease with special reference to its stages and haemodialysis status. *J Clin Diagn Res.* [Internet] 2016;10(12) [acesso em 14 jan 2017]. Disponível: <http://dx.doi.org/10.7860/JCDR/2016/22815.8947>.
20. Leung KCW, Quinn RR, Ravani P, MacRae JM. Ultrafiltration biofeedback guided by blood volume monitoring to reduce intradialytic hypotensive episodes in hemodialysis: study protocol for a randomized controlled trial. *Trials.* [Internet] 2014;(15) [acesso em 14 dez 2016]. Disponível: <http://dx.doi.org/10.1186/1745-6215-15-483>.
21. Teixeira ALF, Ubessi LD, Benetti ERR, Kirchner RM, Barbosa DA, Stumm EMF. Events associated with the daily life of elderly people on hemodialysis. *Ciênc. cuid. Saúde* [Internet] 2015;14(3) [acesso em 14 fev 2017]. Disponível: <http://dx.doi.org/10.4025/cienccuidsaude.v14i3.23003>.
22. Fukushima RLM, Menezes ALC, Inouye K, Pavarini SCI, Orlandi FS. Fatores associados à qualidade de vida de pacientes renais crônicos em hemodiálise. *Acta paul. enferm.* [Internet] 2016;29(5) [acesso em 07 set 2017]. Disponível: <http://dx.doi.org/10.1590/1982-0194201600072>.
23. Almeida KCS, de Sousa MNA, de Oliveira T, Bezerra ALD, Nunes RMV, de Medeiros RC. Atitude religiosa de pessoas com doença renal crônica em tratamento hemodialítico. *Rev Enferm UFPI.* [Internet] 2016;5(2) [acesso em 06 set 2017]. Disponível: <http://www.ojs.ufpi.br/index.php/reufpi/article/view/5042>.
24. Poulidakos D, Banerjee D, Malik M. Major arrhythmic events and T wave morphology descriptors in hemodialyzed patients. *J. Eletrocardiol.* [Internet] 2014;47(2) [acesso em 17 dez 2016]. Disponível: <https://doi.org/10.1016/j.jelectrocard.2013.11.010>.
25. Bonato FOB, Lemos MM, Cassiolato JL, Canziani MEF. Prevalence of ventricular arrhythmia and its associated factors in Nondialyzed Chronic Kidney Disease Patients. *PLoS ONE.* [Internet] 2013;8(6) [acesso 7 dez 2016]. Disponível: <http://doi.org/10.1371/journal.pone.0066036>.
26. Silva LF, Lopes GB, Matos CM, Brito KQ, Amoedo MK, Azevedo MF, et al. Gastrointestinal symptoms and nutritional status in women and men on maintenance hemodialysis. *J Ren Nutr.* [Internet] 2012;22(3) [acesso em 17 dez 2016]. Disponível: <http://dx.doi.org/10.1053/j.jrn.2011.07.007>.
27. Gil FF, Barros MJ, Macedo NA, Júnior CGE, Redoan R, Busatti H, et al. Prevalence of intestinal parasitism and associated symptomatology among hemodialysis patients. *Rev. Inst. Med. trop. S. Paulo.* [Internet] 2013;55(2) [acesso em 17 dez 2016]. Disponível: <http://dx.doi.org/10.1590/S0036-46652013000200001>.
28. Ferraz SF, Freitas ATVS, Vaz IMF, Campos MIVAM, Peixoto MRG, Pereira ERS. Estado nutricional e ganho de peso interdialítico de pacientes com doença renal crônica em hemodiálise. *J. Bras. Nefrol.* [Internet] 2015;37(3) [acesso em 07 set 2017]. Disponível: <http://dx.doi.org/10.5935/0101-2800.20150050>.
29. Silva MS, Marini TSO, da Silva CFB. Enfermagem e suas intervenções nas principais complicações ocorridas durante a sessão de hemodiálise. *Rev. Enfermagem e Saúde Coletiva.* [Internet] 2016;1(2) [acesso em 25 set 2017]. Disponível <http://revesc.org/index.php/revesc/article/view/7>.
30. Murota H. Sweating in systemic abnormalities: Uremia and Diabetes Mellitus. *Curr Probl Dermatol.* [Internet] 2016;51 [acesso em 25 set 2017]. Disponível: <http://dx.doi.org/10.1159/000446760>.