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Original Article

PRINCIPAIS COMPLICAÇÕES APRESENTADAS DURANTE A HEMODIÁLISE EM PACIENTES CRÍTICOS E PROPOSTAS DE INTERVENÇÕES DE ENFERMAGEM

NURSING INTERVENTIONS FOR COMPLICATIONS PRESENTED DURING HEMODIALYSIS IN CRITICALLY ILL PATIENTS

INTERVENCIONES DE ENFERMERÍA PARA LAS COMPLICACIONES PRESENTADAS DURANTE LA HEMODIÁLISIS EN PACIENTES CRÍTICAMENTE ENFERMOS

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RESUMO

Objetivos: Identificar complicações apresentadas durante as sessões de hemodiálise em pacientes de uma terapia intensiva do Distrito Federal. **Métodos**: Estudo descritivo, quantitativo, realizado num hospital público de Brasília, entre junho a agosto de 2015. Os dados foram coletados através de formulário e foram analisadas características como: prescrição da hemodiálise, sinais vitais e complicações durante as sessões de hemodiálise. **Resultados:** Foram analisadas 31 sessões de hemodiálise, com duração de três a quatro horas; 87,1% da amostra apresentaram pelo menos uma complicação; a média de complicações foi de 2,6 por procedimento. As principais complicações identificadas foram hipotensão, arritmias, hipoglicemia, coagulação do circuito extracorpóreo e hipotermia. Após a interpretação dos dados, foram elaboradas intervenções de enfermagem de acordo com *Nursing Interventions Classification (NIC*) de 2015. **Conclusão:** As principais complicações apresentadas foram: hipotensão, arritmias seguidas da hipoglicemia, hipotermia e problemas no circuito extracorpóreo, as quais exigem do enfermeiro, habilidade e conhecimento para reconhecê-las precocemente, de forma que sua competência seja capaz de solucionar intercorrências e garantir a qualidade da assistência.
Descritores: Insuficiência renal; Cuidados Críticos; Diálise renal; Processos de enfermagem.

ABSTRACT

Objectives: To identify complications presented during hemodialysis patients in an intensive care unit of the Federal District. **Methods:** A descriptive, quantitative study conducted in a public hospital in Brasilia, held from June to August 2015. Data were collected through a form with the following data: hemodialysis prescription, vital signs and complications during hemodialysis session. **Results:** 31 hemodialysis sessions were analyzed, lasting three to four hours, 87.1% of patients had at least one complication, averaging 2.6 complications per procedure. The main complications were identified hypotension, arrhythmias, hypoglycemia, clotting of the extracorporeal circuit and hypothermia. After the interpretation of the data were prepared nursing interventions according to Nursing Interventions Classification (NIC) 2015. **Conclusion:** The main complications presented were hypotension, arrhythmias, followed by hypoglycemia, hypothermia and problems in the extracorporeal circuit, which require the nurse's ability and knowledge to recognize early so that their competence is able to solve intercurrences and guarantee the quality of care.
Keywords: Renal insufficiency; Critical Care; Renal dialysis; Nursing process.

RESUMEN

Objetivos: Identificar las complicaciones presentadas durante los pacientes de hemodiálisis en una unidad de cuidados intensivos del Distrito Federal. **Métodos:** Estudio transversal, estudio descriptivo, cuantitativo realizado en un hospital público en Brasilia, que tuvo lugar de junio a agosto 2015. Los datos fueron recolectados a través de formularios con verificación de las siguientes características: prescripción de hemodiálisis, los signos vitales y complicaciones durante la sesión de hemodiálisis. **Resultados:** Se analizaron 31 sesiones de hemodiálisis, con una duración de 3 a 4 horas; 87,1% de los pacientes tenían al menos una complicación; el promedio de complicaciones fue de 2,6 por procedimiento. Después de la interpretación de los datos, se prepararon las intervenciones de enfermería de acuerdo con *Nursing Interventions Classification (NIC*) de 2015. **Conclusión:** Las principales complicaciones presentadas fueron: hipotensión, arritmias, seguidas de la hipoglucemia, hipotermia y problemas en el circuito extracorpóreo, las cuales exigen del enfermero habilidad y conocimiento para reconocerlas precozmente, a fin de que su competencia sea capaz de solucionar las disputas y garantizar la calidad de la asistencia.
Descriptores: Insuficiencia renal; Cuidados críticos; Diálisis renal, Procesos de enfermería.

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INTRODUCTION

Acute Kidney Failure (AKF) is defined as an acute renal function reduction in hours or days, associated with decreased glomerular filtration rate and/or urinary volume and control water-electrolyte balance disorders and acid-base. According to the Acute Kidney Injury Network (AKIN), the classification of the IRA can be based on the percentage of elevation of serum creatinine dosage and/or urinary volume, being classified in stages 1, 2 or 3[1, 2].

The AKD is the most common complication observed in critical patients, its epidemiology varies according to the hospital environment, occurring between 20% to 40% of critically ill patients[3]. A global alert estimates that more than 2 million deaths by AKD each year and those that survive are at increased risk for later development of chronic kidney disease, raising the mortality[2,4]. Ischemic events, nephrotoxic drugs, infectious, obstructive, hypotension, cardiovascular shock, cardiovascular failure, hepatic and respiratory, neoplasms, and average time of stay more than seven days are risk factors for the development of kidney failure[5]. In the world, the septic events are associated with an occurrence in more than 50% of cases and acute renal failure in intensive care unit (ICU), followed by major surgeries and low cardiac output[6].

The clinical frame of AKF relates mainly to the underlying disease and the metabolic changes arising from renal dysfunction. As a result of oliguria and anuria frames, maintenance of water-electrolyte balance, acid-base and excretion of nitrogenous products are compromised[5-6]. Thus, renal therapy substitution (RTS) is the main treatment of the AKF, whose goal is the correction of metabolic abnormalities arising from renal dysfunction, the regulation of the balance and balance sheets influenced by the kidneys (acid-base, electrolyte, volemic and water nutritional). In addition, it aims the handling of extracellular fluid in patients with multiple organic failure, the preservation and help in the recovery of organic functions[1].

Despite the technological advances, increasing the survival of the population and the sophistication of therapy, renal therapy in critical patients is a substitutionary therapy, associated with intercurrences and complications, given the severity of the clinical frame, the presence of hemodynamic instability and the inadequacy or failure of adaptive natural mechanisms of the body[4,5]. Hemodialysis is a highly complex procedure, performed predominantly by nursing, which requires specific knowledge, technical skill, constant surveillance for immediate interventions be implemented against the complications[7].

In this way, it is worth mentioning that the Nursing Interventions Classification (NIC)[8] is an important tool that uniform clinical language of nursing interventions for the registration and selection of necessary actions[8]. Nursing interventions should be decisive for the control of complications from the procedure under hemodialysis. Thus, the objective of this study was to identify the main intra-dyalitical complications and possible nursing interventions contained in the Nursing Interventions Classification (NIC)[8].

METHODS

This is a descriptive study with a quantitative approach, carried out in the ICU of a public hospital of Brasilia-Federal District, in the period from June to August 2015. There were included in the study, through convenience sample, dyalitic patients with diagnosis of AKD, of both genders, with a minimum age of 18 years old, admitted to the ICU of the hospital. Hemodialysis performed was intermittent, the conventional type, with duration of three to 5 hours. There were excluded from the research, patients under the age of 18 and those with renal insufficiency, but without the need for dialysis. For data collection, we used a form of structured issues prepared by the researchers, containing data as: the identification of the patient, prescription of hemodialysis, vital signs and complications occurred during the hemodialysis session. Among the complications evaluated include: hypotension, hypoglycemia, hypothermia, hyperthermia, arrhythmias, give me a by-pass system clotting, lack of flow in the vascular access and bleeds. The criteria used to characterize as complications were: Average Arterial Pressure (AAP) < 65mmHg or > 130mmHg, glycemia < 70 mg/dl, axillary temperature > 35.5° C and stroke < arrhythmic of electrocardiogram (ECG) of the monitor. It was also regarded as intercurrent, the presence of the alarm on the dialysis machine, indicating coagulation with consequent interruption of session, lack of flow and bleeding associated with puncturing or anticoagulation. Intermittent hemodialysis sessions, conventional, were fully tracked.

The data was stored in Microsoft Excel database and subsequently analyzed. Continuous variables were reported as measures of central tendency (average and standard deviation, after test of normality by the Shapiro-Wilk test), while categorical variables were represented in absolute values and percentages.

After the data interpretation, there have been identified the main clinical complications and then selected nursing interventions, according to the nursing Interventions classification (*Nursing Intervention Classification – NIC*) -2015[8]. The research was approved by the Research Ethics Committee FEPECS/SES/DF, under CAAE: 44626014.9.0000.5553. There were assured secrecy and confidentiality of the data, in accordance with resolution Nº 466/2012, of the National Council of health-CNS, which regulates research with human beings in Brazil.

RESULTS AND DISCUSSION

31 hemodialysis sessions were analyzed, of which 15 of these patients were critically ill with AKD in TRS; 87.1% of the patients had at least one complication during the session, and the average was of 2.6 procedure complications. In critical patients, in particular those hemodynamically unstable, there is a strong tendency to the use of continuous renal replacement therapy on intermittent therapy, because of the better maintenance of hemodynamic stability, better volemic control, metabolic and nutrition of patients[5]. All were intermittent hemodialysis sessions, lasting between three to 4 hours, being conducted daily or on alternate days. The intermittent dialysis every other day, occurred at 74.2% patients, while 25.8%, renal therapy, both was substitutionary durations of 3 to 4 hours.

Table 1 - Distribution of intra-dyalitical more prevalent complications during hemodialysis sessions 31 the intensive care unit. Brasilia, 2015.

Intra-dyalitical complications	Absolute frequency	Relative frequency
Hypotension	18	85.7%
Hypothermia	5	16.1%
Hypoglicemy	6	12.9%
Lack of flow in vascular access	5	16.1%
Coagulation of the system	4	12.9%
Cardiac arrhythmias	8	25.8%
Bleeds	2	3.2%

Vascular accesses were deployed, in their most (80.6%), in femoral vein, 16.1% in subclavian vein and 3.2% in the internal jugular vein. It was observed that the preference for puncture in femoral vein due to presence of other devices already installed in other places. The vascular access is key point to start dialysis. In acute cases, commonly used temporary access through the percutaneous insertion of a catheter into a vein deep or become central. It is recommended the insertion of the catheter of hemodialysis in right internal jugular vein because the subclavian is associated with a higher incidence of complications such as pneumothorax, hemothorax, and subclavian artery perfusion, brachial plexus injury and an incidence of up to 40% of stenosis central venous. The evidence indicates the insertion, in femoral access to perform hemodialysis should be restricted and in extreme cases, in the shortest possible time. In addition to the risks mentioned above, another harmful factor related to access in the femoral vein is the largest due to the low flow recirculation peri-catheter[9], although this complication has not occurred in this study.

Complications during hemodialysis in chronic patient are well known; however, when referring to acute patients undergoing hemodialysis in the intensive care unit, many of these demonstrations can go unnoticed, be recognized later or are not related to the procedure, due to existing clinical context[10]. The most prevalent intra-dyalitical intercurrences were hypotension, hypoglycemia (2 cases 4 cases before and after the session ends) and arrhythmias (table 1), these also frequent complications in other studies[8,11].

Source: Data pertaining hemodialysis sessions of the intensive care unit of a public hospital in the Federal district, Brasília, 2015.

Another point to be considered is the venous access patency of hemodialysis. An evaluation of this catheter before starting the procedure, can avoid intra-dyalitical complications and waste of materials. A cross-sectional study and quantitative[11] assessed reports of nursing staff about adverse events in dialysis and found at least one adverse event reporting, hemodialysis catheter related, i.e. 100% of the team witnessed an adverse event involving the vascular access. In addition to the improper position, adverse events of patency

rates can happen as a result of obstruction of the lumen by a clot, preventing the flow of blood to the dialysis machine[10-11]. This study, the occurrence of lack of flow in the vascular access happened in 5 (16.1%), although it has been held the patency test before the start of each session. Assessing the patency rates can be made through the aspiration of contents of heparin and blood present in the catheter, evaluating efflux, and through the infusion of 0.9% saline, evaluating influx[10].

The effect ball-valve is described[10] as the fibrin clot formation, obstructing the distal extremity of the catheter, and may even allow the infusion of solutions, but making the aspiration catheter reflux or difficult. In these cases, it is recommended the reversal of catheter tips (via efflux in intravenous route and route of return on arterial line) or the infusion of systemic thrombolytic[10], for example, the tissue plasminogen activators. It is also suggested as a cause of excessive suction in the influx, the erroneous position of the catheter tip or thrombus in spherical valve. In this study, there were five cases (16.1%) of lack of flow in the vascular access, and, in two cases (6.5%) there were the inversions of the tips of catheters, not being the best practice, but troubleshooting, provisionally, the complication; however associated with the reduction of dialysis efficiency. When it is not possible to perform dialysis with the ends flipped, a new vascular access must be punctured[8].

In this study, there were 4 (12.9%) episodes of the coagulation system. Of the 31 sessions observed, 19 (61.3%) used the system with saline irrigation, periodically, due to contraindication flush, and in 12 (38.7%) used the anticoagulation with heparin dose fractionation between 2500UI/ml to 5000UI/ml, administered in priming itself or infused directly into the line of efflux of give me a by-pass circuit. The coagulation system is, in 40% to 75% of the time, the cause of suspension of dialytic therapy. The clinical state of the patient, the dialysis technique and the materials used are factors that predispose the thrombosis circuits. It is known that, in addition to these factors, the very high flow promotes turbulence as well as low flow (<100 ml/min), promoting blood stasis, both situations, risks to the coagulation process[12]. It is worth mentioning that the septic patients with acute kidney injury has a significant increase of leukocytes and platelets, the clotting cascade, increasing the risk of the clotting system, making it difficult to dialysis without a method of anticoagulation[13]. The coagulation system is a prevalent complication. In this study, the anticoagulation system occurred predominantly in cases of heparin anticoagulation fractionally 5000UI/ml.

Heparin is the most commonly used anticoagulant in dyalitic procedures; however, it may induce thrombocytopenia. Its use is associated with bleeding in up to 30% of cases, thereby increasing the need for transfusion. The incidence of use of heparin in this study was of 26 (83.9%), ranging from 2500 IU to 5000 IU, depending on the clinical/laboratory phase of the patient.

An alternative would be the regional administration of citrate, but it is appropriate to monitor the serum levels of calcium and the risks in patients with patients, in addition to the high costs[14]. In the U.S., the fractional not heparin is the most used, while in the European Union, the low molecular weight heparin is an anticoagulant of choice[10]. It is important to consider that, when a give me a by-pass system gels, there are immediate suspension of dialysis with or without the return of blood to the patient. It is estimated that, in addition to the equipment of the dialyzer, the patient loses approximately 100-150 ml of blood, which is very common in patients where the anticoagulation is contra-indicated[10]. Although this value is acceptable, one should do a clinical and laboratory evaluation, considering the blood loss added by other factors.

In relation to the level of consciousness, 61.3% were sedated; 29.1% were in a state of torpor and 9.7% were aware, these data corroborated by other studies, since, in the ICU, is high the prevalence of individuals in need of superficial or deep sedation[3,4].

Hypotension is a complication more applicant and the most serious in critical patients in renal therapy substitution reported in literature[15]. All patients included in the study were hemodynamically stable, prior to the session, either by basal stability or corrected by vasoactive drugs and volume. Hypotension occurred in 18 (85.7%) of cases; they were hemodynamically unstable patients, before the procedure and use of norepinephrine, hypotensive were not considered during hemodialysis, which may have helped mask a case of hypotension. The main limiting factor of intermittent therapy in critical patients is hemodynamic instability. Intra-dyalitical hypotension, in addition to lower the dose of dialysis offered, perpetuates the ischemic injury,

delaying the recovery of AKD[16]. Intra-dyalitic hypotension is associated with factors related to dialysis (volume and ultrafiltration rate, reduced plasma osmolarity) and the patient (hypovolemia, cardiac dysfunction, vasodilation).

It is possible to adopt some measures to minimize the hypotension as increased sodium concentration, the dialysate temperature decrease, and the use of smaller ultra-filtrate rates, noting that the best TRS for the patient with hemodynamic instability is the continuous hemodialysis extended[17]. In dependent patients doses of norepinephrine greater than 0.2 mcg/kg/min, already becomes preferable to dialysis, as well as in cardiac patients and patients with decompensated patients more prone to intra-dyalitical hypotension[8].

In relation to Glycemic monitoring, measurement of blood glucose was made of 3 to 5 minutes before the hemodialysis during the session (after 2 hours of the start of dialysis) and 3 to 5 minutes after the end of hemodialysis. Hypoglycemia is a complication that needs to be avoided and there should be regular checking of glycemic control[10]. In this study, hypoglycemia was present in 9.7%, before the hemodialysis; 12.9%, during; 6.5% after hemodialysis. There was the blood glucose before, during and after the dialysis procedure, which proves the need to be determined at least twice during the hemodialysis procedure. It is worth mentioning that the Glycemic measurement can be performed by blood capillary, arterial and venous once in patients hemodynamically unstable, capillary blood can introduce spurious results[10,17]. In this study, we opted for the blood sample of the venous line give me a by-pass circuit that, for many times, differed from the result.

Another important complication analyzed in this study was hypothermia, and five (16.1%) of observed sessions presented axillary temperature, measured with thermometer, down 35.5°C. Although the explanation of hypothermia in hemodialysis sessions is not completely understood, is recurring in THREE solid and can be explained by the longer time of cardiopulmonary bypass; however, it is less common in intermittent dialysis, because there is a temperature sensor on the machine that monitors the temperature of the dialysis solution[8-15]. An integrative review[15] on the complications during the hemodyalisis found it difficult to correlate the episode of hypothermy of the hemodialysis procedure, but the authors claim that the hypothermy must be avoided by increasing the rate of mortality. It is important to note the body temperature before starting hemodialysis so that, in case of hypothermy, it could relate to the procedure.

Based on intra-dyalitical complications identified in this study and considering the importance of recognizing the demands of the patient, it is necessary that nursing interventions are established. It is noteworthy that these are in care, which aim to address the identified demand and, along with the actions of the multidisciplinary team, improve the clinical condition of the patient[11,17]. In this study, nursing interventions have been proposed according to the nursing interventions Classification (NIC)[8] (to the hemodialysis procedure) and specific to intra-dyalitical complications, as evidenced by the figures 1 and 2.

Figure 1 - Proposal for nursing interventions for the hemodialysis procedure, according to *NIC* (2015)[8].

Procedure	Nursing Interventions
HEMODYALISIS	Check the equipment and solutions, according to protocol.
	Use sterile technique to initiate hemodialysis and for catheter connections and secure connections well.
	Use of EPI's to avoid direct contact with the patient's blood.
	Initiate hemodialysis and administer heparin according to protocol.
	Check the system monitors to ensure patient safety.
	Monitor the blood pressure, pulse, respiration, temperature and patient response during dialysis and interrupt dialysis, according to protocol.
	To establish the appropriate protocol if the patient gets hypotension.
	Compare Vital signs post-dyalisis and the blood chemical data with the pre-dialysis values.

Source: Classification of Nursing interventions – *Nic*, 2015.

Figure 2 - Proposal for nursing interventions for intra-dyalitical complications, second *Nic* (2015)[8].

Interventions	Nursing Interventions
Maintenance of CENTRAL VASCULAR access/Dialysis	Monitor the emergence of catheter occlusion signals (check the catheter patency rates before procedure).
	Monitor the access site for bleeding.
	Heparinize the newly inserted and hepar catheter the catheter after dialysis or every 72 hours.
Arrhythmia Control/Cardiac assistance	Determine, With the patient or family, The history of illness and cardiac arrhythmias.
	Monitor and correct acid-basic and electrolytic imbalances capable of precipitating arrhythmias.
	Ensuring constant monitoring of the ECG.
	Monitor the hemodynamic response to the arrhythmia and Annotate the occurrence, Frequency and duration of the same.
	Ensuring access to the medication emergency for arrhythmias and administer IV fluids and prescribed vasoconstrictors agents, as indicated, to facilitate perfusion tissue.
	Provide Antiarrítmica therapy (medication, cardioversion or defibrillator).
	Monitor patient responses after Antiarrítmica therapy and monitor the occurrence of dyspnoea, fatigue, tachypnea and orthopnea.
Hemodynamic adjustment	Listen to heart sounds and admit the presence of changes in blood pressure.
	Administer positive mentor's medicines to contractibility and evaluate their effects.
	Monitor and document frequency, rhythm and cardiac beetings and monitor pulse, capillary perfusion, temperature and color of the extremities.
	Maintaining water equilibrium, administering liquids or diuretics, as appropriate and assessing the effects of water therapy.
	AdminisBring medicine Vasodilator and/or vasoconstrictor, as appropriate and administer medicines antiarrhythmics, as appropriate and monitor effects.
Water monitoring	Determining potential factors of risk of water imbalance (hyperthermia, diuretics, heart failure, kidney pathologies, sweating, liver dysfunction, infection, postoperative state, Polyuria, Vomiting and Monitor weight.
	Monitor ingestion and disposal and keep the precise record and monitor the mucous membranes, turgor pressure of the skin and thirst.
	Monitor serum and urinary electrolyte values, monitor values of serum albumin and total protein and monitor levels of serum and urinary osmolarity.
	Monitor blood pressure, heart rate and respiratory status.
	Monitor hemodynamic parameters, as appropriate.
	Monitor color, quantity and specific gravity of urine.
	Monitor the occurrence of distension of neck veins, lung crackle, peripheral edema and weight increase.
	Administer liquids or restrict liquids intake.
	Administer dialysis, as appropriate, observing the patient's response.
Hypoglycemia control	Identify the patient's risk hypoglycemia and to monitor levels of blood glucose.
	Determine the recognition of signs and symptoms of hypoglycemia.
	Monitor the emergence of signs and symptoms of hypoglycemia (tremors, perspiration, tachycardia, palpitations, chills, unit in the skin, delirium, pallor, hunger, nausea, headache, warmth, dizziness, fainting, confusion, bedridden, convulsion).
	Administer glucose if necessary.
	Revise events prior to hypoglycemia to determine the possible cause.
Treatment of hypothermia	Cover with heated blankets or heat the patient.
	Monitor and record patient temperature with a thermometer.
	Installing appliance for continuous monitoring of the central temperature, as it suits.
	Monitor the skin color.
	Monitor the occurrence of bradycardia, electrolytic imbalance, acidobásico and cardiac debit.
	Monitor the respiratory status.

Source: Classification of Nursing interventions – NIC, 2015.

It is worth mentioning that intradialíticas complications encountered and proposed interventions are in line with other studies[8,11,13,17], since these include interventions to minimize the changes hidroeletrolíticas, glucose, besides hemodynamic maintenance-related care and good functionality of the dialysis catheter.

The lack of a record of observations and nursing control has been identified as a limiting factor of the study. The use of a formal record and routine, describing the procedure and

complications presented during hemodialysis sessions, would help to plan the next session and prevent further complications.

Through the results found in this study, it was suggested the implementation of a development of nursing, containing notes of blood pressure time, heart rate, blood sugar levels and other complications, as well as other vital signs and prescription of hemodialysis. Simple measures like this could increase security procedures and, consequently, improve the quality of assistance provided.

CONCLUSIONS

In this study, the main complications intra-dyalitical were those related to the hemodynamic system: hypotension and arrhythmias. It was also observed the occurrence of hypothermia, hypoglycemia, the coagulation system and lack of vascular flow.

Although obvious technological advances in the area of dialysis, the use of secure protocols and techniques, yet the patient is prone to complications during dialytic therapy, which requires the intensive care nurse and nephrologist, a vast knowledge and clinical a comprehensive dexterity with the resources employed in these proceedings.

A systematic and independent care planning of care employees in daily routine should be constructed so that assist all nursing staff involved in dialysis. The use of institutional protocols validated facilitates and promotes greater security interventions carried out.

So, by the observation of the aspects analysed, it can be affirmed that it was possible to identify the main present complications during dialysis in critically ill, being possible to describe the main interventions that helped in providing direct and continuous care to the patient on hemodialysis, ensuring a safe procedure and an effective result.

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