

COMPLICATIONS DURING DIALYSIS AND REASONS FOR INTERRUPTION OF HEMODIALYSIS

COMPLICAÇÕES INTRADIALÍTICAS E MOTIVOS DA SUSPENSÃO DA SESSÃO DE HEMODIÁLISE

COMPLICACIONES DURANTE LA DIÁLISIS Y RAZONES PARA INTERRUMPIR LA HEMODIÁLISES

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ABSTRACT

Hemodialysis is a procedure to remove harmful metabolic waste from the blood. Complications during the dialysis procedure are related to the patient's clinical condition, the quality of the hemodialysis, and the hydroelectrolytic imbalance. The main complications described during the dialysis procedure include: hypotension, hypoglycemia, muscle cramps, nausea, vomiting, headache, chest and back pain, fever, and chills. The objective of this study was to describe the main complications during the dialysis procedure and the reasons for hemodialysis suspension. A retrospective, descriptive, and quantitative approach was used. From July to August 2023, we analyzed 906 hemodialysis sessions performed by 89 patients and their reported complications. Arterial hypotension was identified as the most prevalent event during the sessions, occurring in 30.5% of them. A total of 78 sessions were suspended, with arterial hypotension being the most frequent cause of hemodialysis procedure suspension. This study demonstrates the need to develop strategies to monitor and intervene in the factors leading to session suspension. The action should be multifactorial and involve the entire healthcare organization, engaging professionals involved in patient care, mastering each complication and its intervention.

Keywords: *Renal Dialysis; Hypotension; Withholding Treatment.*

RESUMO

A hemodiálise é um procedimento em que se extrai do sangue resíduos prejudiciais ao metabolismo. As intercorrências durante o procedimento dialítico estão relacionadas à condição clínica do paciente, à qualidade da hemodiálise e ao desequilíbrio hidroeletrólítico. São descritas como as principais complicações do procedimento dialítico: hipotensão, hipoglicemia, câibras musculares, náuseas, vômitos, dor de cabeça, dores no peito e nas costas, febre e calafrios, principalmente. O objetivo deste estudo foi descrever as principais intercorrências durante o procedimento dialítico e os motivos que levaram à suspensão da hemodiálise. Foi realizado um estudo retrospectivo, descritivo e de abordagem quantitativa. No período de julho a agosto de 2023, analisamos 906 sessões de hemodiálise realizadas por 89 pacientes e as intercorrências relatadas nas sessões. Identificamos a hipotensão arterial como o evento mais prevalente durante as sessões, em 30,5% destas. Um total de 78 sessões sofreram suspensão. A hipotensão arterial foi apresentada como a causa mais frequente de suspensão do procedimento hemodialítico. Este estudo demonstra a necessidade de levantar estratégias que possibilitem monitorar e intervir nos fatores que levam à suspensão da sessão de HD. A ação deve ser multifatorial e envolver toda a organização de saúde, engajando os profissionais que realizam a assistência, dominando cada intercorrência e sua intervenção.

Descritores: *Diálise Renal; Hipotensão; Suspensão de Tratamento.*

RESUMEN

La hemodiálisis es un procedimiento en el que se extraen del torrente sanguíneo los residuos metabólicos perjudiciales. Las complicaciones durante el procedimiento de diálisis están relacionadas con la condición clínica del paciente, la calidad de la hemodiálisis y el desequilibrio hidroelectrolítico. Las principales complicaciones del procedimiento de diálisis descritas son: hipotensión, hipoglucemia, calambres musculares, náuseas, vómitos, dolor de cabeza, dolor en el pecho y en la espalda, fiebre y escalofríos, principalmente. El objetivo de este estudio fue describir las principales complicaciones durante el

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procedimiento de diálisis y las razones que llevaron a la suspensión de la hemodiálisis. Se realizó un estudio retrospectivo, descriptivo y cuantitativo. En el período de julio a agosto de 2023, se analizaron 906 sesiones de hemodiálisis realizadas por 89 pacientes y las complicaciones reportadas en las sesiones. Se identificó la hipotensión arterial como el evento más prevalente durante las sesiones, en un 30,5% de estas. Un total de 78 sesiones fueron suspendidas. La hipotensión arterial se presentó como la causa más frecuente de suspensión del procedimiento de hemodiálisis. Este estudio demuestra la necesidad de desarrollar estrategias que permitan monitorear e intervenir en los factores que llevan a la suspensión de la sesión de HD. La acción debe ser multifactorial e involucrar a toda la organización de salud, comprometiendo a los profesionales que brindan la atención, dominando cada complicación y su intervención.

Descriptores: *Diálisis Renal; Hipotensión; Privación de Tratamiento.*

INTRODUTICON

Kidney injury is a global public health problem, affecting about 750 million people worldwide¹.

Once kidney damage has occurred, its extent and severity can lead to temporary or irreversible loss of kidney function.

During hospitalization, kidney injury occurs due to Acute Kidney Injury (AKI) or exacerbating CKD. However, Acute Kidney Injury (AKI) is the most common type of injury in the hospitalized population. It is characterized by an abrupt reduction in renal function, with an increase in serum creatinine and/or a reduction in urine flow. It is a frequent complication in the Intensive Care Unit (ICU)².

It is identified that, in hospitalized patients, there are previous comorbidities causing progressive kidney injury. Together with these comorbidities, these patients are exposed to nephrotoxic drugs in the hospital environment, leading to temporary loss of renal function during hospitalization^{3,4}.

Mortality in AKI is extremely high, affecting 40 - 80% of patients. The association between sepsis and AKI causes high mortality and increases significantly if renal replacement therapy (RRT) is required².

Renal replacement therapies (RRT) that can be instituted are peritoneal dialysis (PD) or hemodialysis (HD)⁵.

Hemodialysis is a procedure in which residues that are harmful to metabolism are extracted from the blood, using a machine that performs cardiopulmonary bypass⁶.

Complications during the dialysis procedure are related to the patient's clinical condition, the quality of hemodialysis and the fluid and electrolyte imbalance⁷.

The main complications of the dialysis procedure are: hypotension, hypoglycemia, muscle cramps, nausea, vomiting, headache, chest and back pain, fever and chills, anticoagulation, imbalance syndrome, hypersensitivity reactions, cardiac arrhythmias, intracranial hemorrhage, seizures, gas embolism, and cardiorespiratory arrest⁸.

Hypotension is the main complication of the hemodialysis procedure, related to excessive interdialytic weight gain, autonomic neuropathy, use of antihypertensive drugs, high rate of ultrafiltration prescribed, and abnormalities in electrolyte concentration⁹.

The outcome of the main complications during the hemodialysis session is the

suspension or early termination of this hemodialysis session. The suspension of the session has clinical impacts, since the patient has not performed the total purification of the slag and economic impacts, as it will be necessary to have a new hemodialysis session sooner, with recurrent costs of new prescription, with the need for new hospital material, human resources and technological resources.

The objective of this study was to describe the main complications during the dialysis procedure and the reasons that led to the suspension of hemodialysis.

This study is justified because the results obtained will allow the comparison of care strategies and quality control during hemodialysis sessions, with improvements in treatment, reduction of complications and cost-effectiveness.

METHODS

A retrospective, descriptive study with a quantitative approach was conducted. By means of the follow-up sheets of 906 hemodialysis sessions, data regarding interurrences and suspensions of hemodialysis sessions were collected.

Data collection involved the period from July to August 2023 and included patients diagnosed clinically and laboratorially with acute and chronic kidney disease, on hemodialysis, over 18 years of age, and using any central access for HD: arteriovenous fistula, double lumen catheter, or permcath.

The data were organized in a Microsoft Excel program, Office 365 version, and the statistics were implemented by this program. The place where the research was conducted was the Waldemar de Alcântara General Hospital, in Fortaleza, Ceará. The research was approved by the Research Ethics Committee, under opinion CEP-ISGH-N° 6.625.830.

RESULTS

A total of 906 sheets referring to hemodialysis sessions performed from July to August 2023 were analyzed.

Table 1 shows that the sample consisted of 89 patients with renal dysfunction undergoing hemodialysis, 62% of whom were male and 38% female. The mean age was 63 years, ranging from 26 to 72 years.

The distribution of patients in the hospital sectors was 60% hospitalized in the Medical Clinics, 10% in the Special Care Unit, 3% in the Stroke Unit and 27% in the Intensive Care Unit.

Table 1. Description of the sample.

<i>Variables</i>	<i>n</i>	<i>%</i>
<i>Patients</i>	89	
Age (average)	63 years old (range 26 to 72 years)	
Sex		
Male	55	62
Female	34	38

<i>Inpatient Units:</i>		
<i>1. Medical Clinics</i>	<i>53</i>	<i>60</i>
<i>2. Special Care Unit</i>	<i>09</i>	<i>10</i>
<i>3. Stroke Unit</i>	<i>03</i>	<i>03</i>
<i>4. Intensive Care Unit</i>	<i>24</i>	<i>27</i>

Source: data obtained from the sheets of hemodialysis sessions.

Table 2 shows the temporary (CDL) and permanent (AVF and PERMCATH) approaches used by the patients during the hemodialysis sessions.

About 92% of patients use the central access for hemodialysis, called a double-lumen catheter (CDL). Among the permanent access, 4% had permcath and 3% had AVF as access to HD.

Regarding the insertion site of the CDLs and Permcaths, 66.3% of the patients had the catheter implanted in the femoral veins, while 31.4% had the catheter in the jugular veins and 2.3% in the subclavian veins.

Table 2. Access used by patients for hemodialysis and HD sessions performed.

<i>Access</i>	<i>n</i>	<i>%</i>	<i>HD Sessions</i>
<i>CDL</i>	<i>82</i>	<i>92</i>	<i>809</i>
<i>Permcath</i>	<i>04</i>	<i>04</i>	<i>55</i>
<i>FAV</i>	<i>03</i>	<i>03</i>	<i>13</i>
<i>Femoral Veins</i>	<i>57</i>	<i>66,3</i>	
<i>Subclavian veins</i>	<i>02</i>	<i>2,3</i>	
<i>Jugular Veins</i>	<i>27</i>	<i>31,4</i>	

Source: data obtained from the sheets of hemodialysis sessions.

Table 3 shows the complications described during the hemodialysis sessions. Hypotension was the most prevalent complication in the sessions, occurring in 30.5% of the total number of sessions performed. The presence of low flow in the central venous catheter for hemodialysis was prevalent in 10.9% of the sessions. In 6.6% of the sessions, there was hypoglycemia, with a Dx result lower than 70 mg/dl and the need for intravenous glucose administration. Coagulation of the hemodialysis system was reported in 3.5% of hemodialysis sessions. The incidence of chills during HD was 1.5%. In 8.4% of the sessions, there was a need to end the treatment early, characterizing its suspension in less time than prescribed by the nephrologist.

Table 3. Complications during the hemodialysis session and suspension of the session

<i>Complications</i>	<i>n</i>	<i>%</i>
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<i>Hypotension</i>	276	30,5
<i>Low Flow</i>	99	10,9
<i>Hypoglycemia</i>	60	6,6
<i>Coagulation of the system</i>	32	3,5
<i>Chills</i>	14	1,5
<i>Suspension of the sitting</i>	78	8,6

Source: data obtained from the sheets of hemodialysis sessions.

Table 4 shows the reported problems that led to the suspension of the hemodialysis session. Hypotension stands out, with 37.2% of cases, followed by coagulation of the HD system and a non-flow catheter. Among those with lower incidence, ostium bleeding, blister problems, seizures, chills, CRP, bruises and chest pain stand out with lower incidences than 2 cases in this study.

Table 4. Problems reported for suspension of the hemodialysis session

<i>Reported Issues Suspending HD Session</i>	<i>n</i>	<i>%</i>
<i>Full HD Suspension</i>	78	100
<i>Hypotension</i>	29	37,2
<i>Coagulation of the system</i>	19	24,3
<i>Cateter as fluxo</i>	10	12,8
<i>Lack of light/water</i>	06	7,6
<i>Other</i>	04	5,1
<i>Convulsion</i>	02	2,6
<i>Bubble Picker Problems</i>	02	2,6
<i>Bleeding in ostium</i>	02	2,6
<i>Chills</i>	01	1,3
<i>Cardiorespiratory arrest</i>	01	1,3
<i>Chest pain</i>	01	1,3
<i>Haematoma</i>	01	1,3

Source: data obtained from the sheets of hemodialysis sessions.

DISCUSSION

The largest proportion of patients undergoing hemodialysis at our hospital is male, with 62% (n=55). This finding is similar to that found by Oliveira *et al*¹¹ who, when characterizing the profile of hemodialysis patients, found that 47.1% of the sample were male. Nerbass *et al*¹⁰, in the publication of the Brazilian Dialysis Census, the largest survey of data and number of samples, showed that there are more men on dialysis, with 58% of presence in dialysis centers.

The mean age found in this study was 63 years. This value is higher than that

reported in the study by Nerbass *et al*¹⁰, in which the 45 to 64 age group had the highest share of dialysis patients, and that of Oliveira *et al*¹¹, which was 47 years old.

However, in our hospital institution, the year 2023 showed a higher patient profile in the age groups between 60 and 80 years old, mainly in the medical clinics sector, making up about 45% of our patients. If we include those over 80 years of age seen in medical clinics, we find 59% of patients seen over 60 years of age.

In our study, dialysis patients were present in greater numbers (60% of the sample) in medical clinics. In our hospital, the medical clinics sector has 153 beds available, attending, among other demands, dialysis patients.

We identified that 92% of our dialysis patients use a dual-lumen central catheter for hemodialysis (CDL) and that permanent hemodialysis accesses, such as permcath and arteriovenous fistula (AVF), represent only 4% and 3%, respectively.

According to Neves Junior *et al*¹², central venous catheters are indicated in cases of emergency hemodialysis or in cases in which AVF is not possible.

These findings of prevalence of temporary access of the CDL type in our unit, to the detriment of permanent access, corroborate the clinical profile of our patients, who arrive in an emergency situation, needing to start treatment, with the option being CDL implantation.

The implantation of this DLC occurs in large-caliber central veins, such as the jugular, femoral, and subclavian veins. In our study, the prevalence of these catheters was implanted in the femoral veins in 66.3% of the patients, in the jugular veins in 31.4% of the patients, and in the subclavian veins in 2.3% of the patients. According to Neves Junior *et al*.¹² They should preferably be implanted in the jugular veins, where complications are less. The second choice is between the femoral and subclavian veins. Central vein stenoses occur mainly in the subclavian vein. The management of the vessel to be chosen for LDC implantation has sometimes not happened, as patients come regulated from other hospitals and urgent and emergency care units, arriving with the DLC already punctured and for continuity of hemodialysis treatment.

In this study, we analyzed 906 hemodialysis sessions performed by 89 patients with AKI and/or acute CKD, obtaining the complications reported during the sessions.

Hypotension was identified as the most prevalent event during the sessions, in 30.5% of them.

In their study, Salatiel *et al*¹³ mentioned hypotension as the most common complication, being present in 20% to 30% of dialysis, resulting from the patient's delicate clinical condition and the hemodynamic instability caused by the hemodialysis procedure itself.

Another relevant complication is the coagulation of the hemodialysis system. In our study, about 3.5% of hemodialysis sessions (n=32) had their systems coagulated during the session.

In our service, we use heparin and its anticoagulant function to prevent thrombus formation and loss of the patient's dialysis system. However, patients at imminent risk of bleeding or whose clotting status is unknown will be dialyzed without heparin.

According to Carlos¹, hemorrhagic events due to uremia or liver disease as an underlying disease, postoperative period of surgeries, among other pathologies that

present a risk of bleeding, make the use of heparin potentially dangerous.

However, with dialysis without heparin, the complication of coagulation of the system is imminent.

Performing HD without heparin brings another coagulation phenomenon that occurs in the lumen of the CDL, leading to the formation of thrombi, resulting in the reduction of the lumen and blood flow in the catheter. This intralumen thrombosis may end with total obstruction of the DLC lumen and the need to change the device.

Hypoglycemia is another complication described in this study and affected 6.6% (n=60) of the HD sessions. According to Burmeister *et al*¹⁵, hypoglycemia may occur during the hemodialysis session in patients with Diabetes Mellitus (DM) using glucose-free dialysate.

In our institution, the acidic solution does not have glucose in its composition, and capillary glucose is monitored during HD to prevent hypoglycemia during sessions.

The presentation of chills as an intercurrent by the hemodialysis patient was 1.5% (n=14). The presence of chills raises an alert of the probable contamination of the device and the incidence of probable Bloodstream Infection (BSI).

Okay as Llapa-Rodrigues¹⁶, ICS is a complication of long-term CDL use and, when left untreated, is associated with poor health outcomes.

Table 4 shows the reasons for the suspension of hemodialysis sessions. A total of 78 sessions were suspended. It can be seen that the factors reported as reasons for the suspension of treatment are due to the intercurrents mentioned above and their aggravated clinical picture, and are not subject to resolution.

Hypotension was the most frequent cause of discontinuation of the hemodialysis procedure.

According to Castro¹⁴, hypotension can vary in intensity. Hypotensive symptoms are sometimes related to advanced ultrafiltration. There are procedures that can reverse hypotension, avoiding the suspension of the HD session, such as the introduction of 0.9% sodium chloride solution, reduction of dialysate temperature, correction of hypoalbumin and anemia, for example.

However, in patients with heart failure or in patients who have recently been using antihypertensive drugs, it may be difficult to reverse the consequences of hypotension, with hemodynamic instability setting in, and it is necessary to end the HD session.

Coagulation of the hemodialysis system with subsequent loss of LDC flow was responsible for 24.3% and 12.8% of session suspensions, respectively.

According to Oliveira *et al*.¹¹, citrate is an option for the use of heparin in cases of need to suspend the anticoagulant for intravenous use and to fill the lumens of the DLC at the end of the HD session. Citrate acts by chelating calcium, functioning as a local anticoagulant, inactivating cation-dependent factors in the coagulation cascade.

Other clinical and environmental factors are reported and have a lower incidence in the suspension of HD sessions, such as lack of light and water due to problems external to the institution and clinical factors, such as seizures, bleeding from the CDL ostium, problems in the bubble-catcher machines, cardiorespiratory arrest and hematoma, with a frequency of less than two cases in the study.

CONCLUSION

The introduction of continuous technological advances in hemodialysis has brought us security and confidence in the care practices involving this highly complex procedure.

However, continuous studies are carried out in order to reduce and prevent complications during the dialysis procedure and their consequences, which are often severe and fatal.

This study demonstrates the need to develop strategies that make it possible to monitor and intervene in the factors that lead to the suspension of HD sessions. The action should be multifactorial and involve the entire health organization, engaging the professionals who provide care, mastering each complication and its intervention.

Health management should promote patient safety policies, implementing a vigilant organizational environment during the hemodialysis procedure, focusing on monitoring indicators, continuously evaluating dialysis processes and measuring results, with the participation of all those who care for dialysis patients.

REFERENCES

1. Saadi G, Bello AK, Crews DC. Burden, access, and disparities in kidney disease. *Journal of Nephro.* 2019;32:1-8.
2. Laranja SMR, Areco KCN, Azedo FA, Pinheiro KHE. Risk factors and mortality in patients with sepsis, septic and non septic acute kidney injury in icu. *Braz J Nefrology*, 2019.
3. Blantz RC, Rifkin DE, Singh P. Chronic Kidney Disease: an inherent risk factor for acute kidney injury?: *Clin J Am Soc Nephrol.*2010;5:1690 –5.
4. Medeiros e Silva LV, Dias RS, Souza SMA, Silva GAS, Lopes MLH, Oliveira DPS. Socioeconomic and clinical profile of patients in hemodialytic program. *Rev Enfer UFPE.* 2017.
5. Hobbs FDR, Lasserson DS, O Callaganc A, Hirst JA, Oke JL, Fatoba ST, Hill NR. Global prevalence of chronic kidney disease – a systematic review and meta-analysis: *Plos One*, 2016.
6. Santos Silva LN, et al. Clinical and socio-demographic profile of hemodialysis patients. *Rev Enfer Atual in Derme.* 2020;93(31).
7. Evaristo LS, Cunha AP, Morais CG, Samselski BJL, Esposito EP, Miranda MKV, Gouvêa-e-Silva LF. Complicações durante a sessão de hemodiálise. *Av Enferm.* 2020;38(3):316-324. DOI: <https://doi.org/10.15446/av.enferm.v38n3.84229A>.
8. Atik D, Karatepe H, Karatepe C, Demir S, Sökmen S. The effect of gender on the complications, pain intensity and pain management in hemodialysis patients. *Int J Res Med Sci.* 2016;4:1490-5.
9. Fatima T, Afzal A, Ashraf S. Chronic kidney disease; acute intradialytic complications in chronic kidney disease patients on hemodialysis. *Professional Med J.* 2018;25(6):887-91. DOI:10.29309/TPMJ/18.4418.
10. Nerbass FB, Helbert NL, Thomé FS, Vieira Neto OM, Sesso R. Censo Brasileiro de Diálise 2020. *Braz J Nephro.* 2022;44(3):349-57.
11. Oliveira LV, Ferreira SOS, Mello BA, Khouri NA. Uso de heparina versus citrato em cateter de hemodiálise: uma revisão sistemática. *out./dez.* 2022;46 [supl. 1]:132-43.
12. Neves-Junior MA, Petnys A, Melo RC, Rabonni E. Vascular access for hemodialysis : whats new? *J Vasc Bras.* 2013 jul./set;12(3):221-225. DOI: <https://dx.doi.org/10.1590/jvb.2013.044>.
13. Salatiel KV, Ferreira WFS, Oliveira EC. Intervenções de enfermagem frente às principais intercorrências durante o procedimento de Hemodiálise. *Rev Saúde Desenv.* 2018;12(13).

14. Castro MCM, Atualização em diálise: complicações aguras em hemodiálise. *J Bras Nefrol.* 2001;23(2):108-13.
15. Burmeister JE, Campos JF, Miltersteiner DR. Effect of different levels of glucose in the dialysate on the risk of hypoglycaemia during hemodialysis in diabetic patients. *Braz J Nephrol.* 2012;34(4):323-7.
16. Llapa-Rodríguez EO, Oliveira JKA, Melo FC, Silva GG, Mattos MCT, Macieira Jr VP. Insertion of central vascular catheter: adherence to infection prevention bundle. *Rev Bras Enferm.* 2019;72(3):774-9. DOI: <http://dx.doi.org/10.1590/0034-7167-2018-0124>.