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Accuracy of the defining characteristics of the nursing diagnosis hypothermia in patients on hemodialysis

Acurácia das características definidoras do diagnóstico de enfermagem hipotermia em pacientes em hemodiálise

Exactitud de las características definitorias del diagnóstico de enfermería hipotermia en pacientes en hemodiálisis

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ABSTRACT

Objective: to analyze the accuracy of the defining characteristics of hypothermia in patients on hemodialysis. **Methods:** a diagnostic accuracy study was assembled within a cross-sectional study with 124 patients from two dialysis centers. A latent class model was used for data analysis. **Results:** the nursing diagnosis hypothermia was present in 13 (10.48%) study participants. The most prevalent defining characteristics were hypoxia (100%), decrease in blood glucose level (83.1%), hypertension (65.3%), piloerection (45.2%), and skin cool to touch (41.1%). The defining characteristics acrocyanosis (99.96%) and cyanotic nail beds (99.98%) had a high sensitivity. Acrocyanosis (91.8%), skin cool to touch (64.8%), and peripheral vasoconstriction (91.8%) had high specificity. **Conclusion:** specific and sensitive indicators of hypothermia work as good clinical indicators for confirming this diagnosis in patients on hemodialysis. The study findings can assist nurses in their clinical reasoning for a correct inference of hypothermia.

Descriptors: Nursing; Nursing Diagnosis; Hypothermia; Renal Insufficiency, Chronic; Renal Dialysis.

RESUMO

Objetivo: analisar a acurácia das características definidoras de hipotermia em pacientes em hemodiálise. **Métodos**: estudo de acurácia diagnóstica, com delineamento transversal, realizado com 124 pacientes de dois centros de diálise. Um modelo de classe latente foi utilizado para a análise de dados. **Resultados**: o diagnóstico de enfermagem hipotermia esteve presente em 13 (10,48%) participantes do estudo. As características definidoras mais prevalentes foram hipóxia (100%), redução da glicemia sanguínea (83,1%), hipertensão (65,3%), piloereção (45,2%) e pele fria ao toque (41,1%). As características definidoras acrocianose (99,96%) e leitos ungueais cianóticos (99,98%) apresentaram alta sensibilidade. Acrocianose (91,8%), pele fria ao toque (64,8%) e vasoconstrição periférica (91,8%) apresentaram alta especificidade. **Conclusão**: os indicadores específicos e sensíveis de hipotermia são bons indicadores clínicos para confirmar esse diagnóstico em pacientes em hemodiálise. Os resultados deste estudo podem auxiliar os enfermeiros em seu raciocínio clínico para uma inferência correta de hipotermia.

Descritores: Enfermagem; Diagnóstico de Enfermagem; Hipotermia; Insuficiência Renal Crônica; Diálise Renal.

RESUMEN

Objetivo: analizar la exactitud de las características definitorias de la hipotermia en pacientes en hemodiálisis. **Métodos:** estudio de exactitud diagnóstica, con diseño transversal, realizado con 124 pacientes de dos centros de diálisis. Se utilizó un modelo de clases latentes para el análisis de datos. **Resultados:** el diagnóstico de enfermería hipotermia estuvo presente en 13 (10,48%) participantes del estudio. Las características definitorias más prevalentes fueron hipoxia (100%), reducción de la glucosa en sangre (83,1%), hipertensión (65,3%), piloerección (45,2%) y piel fría al tacto (41,1%). Las características definitorias de acrocianosis (99,96%) y lechos ungueales cianóticos (99,98%) mostraron alta sensibilidad. La acrocianosis (91,8%), la piel fría al tacto (64,8%) y la vasoconstricción periférica (91,8%) mostraran alta especificidad. **Conclusión:** los indicadores específicos y sensibles de hipotermia son buenos indicadores clínicos para confirmar este diagnóstico en pacientes en hemodiálisis. Los resultados del estudio pueden ayudar a las enfermeras a inferir correctamente la hipotermia.

Descriptores: Enfermería; Diagnóstico de Enfermería; Hipotermia; Insuficiencia Renal Crónica; Diálisis Renal.

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INTRODUCTION

The language of nursing diagnoses consists of standardized terminology that categorizes and describes nurses' clinical reasoning[1]. Currently, the nursing diagnoses proposed by NANDA-I are the best known and applied worldwide and among them we have hypothermia (00006). The hypothermia nursing diagnosis is defined as "core body temperature below the normal diurnal range in individuals > 28 days of life". This diagnosis was approved and inserted in the NANDA-I taxonomy in 1986, revised in 1988, 2013, 2017, and 2020, being listed in the 2021-2023 edition with the new definition mentioned above[2].

At risk populations belonging to the hypothermia nursing diagnosis include individuals who have increased body surface area concerning their weight, economically disadvantaged people, extremes of age and weight, and individuals with an insufficient supply of subcutaneous fat[2]. Although patients with chronic renal insufficiency (CRI) on hemodialysis are not part of the "at risk populations" presented by NANDA-I, published studies show that this public has several clinical complications during hemodialysis, including hypothermia[2-3]. It is questioned, therefore, the inclusion of the renal patient population on hemodialysis as one of the populations at risk for this nursing diagnosis.

In a previous study[4], the hypothermia nursing diagnosis was found in 61.8% of chronic renal patients on hemodialysis, being a potential condition for health problems. This diagnosis is considered an important adaptive phenomenon presented by chronic renal patients on hemodialysis[5]. Another study analyzed hemodialysis complications and revealed that hypothermia was the second most prevalent complication[6].

Low temperature occurs in patients undergoing hemodialysis due to the cooling of the blood through extracorporeal circulation, as bloodline and/or dialysate solution are exposed to room temperature, which causes heat loss through thermal convection[5]. Furthermore, hypothermia results from clinical manifestations such as hyponatremia and hypokalemia, and this makes it an important clinical sign for other complications of CRI[3].

Kidney disease currently affects about 850 million people worldwide, accounting for at least 2.4 million deaths each year. It is estimated that around two million patients worldwide are on hemodialysis. It is also believed that this disease will become the fifth leading cause of death worldwide in up to twenty years[7]. In Brazil, for instance, about 93.2% of patients with CRI undergo hemodialysis treatment[8].

Therefore, considering the epidemiology of the disease and its impact on public health and patients' quality of life, hypothermia must be identified and prevented in renal patients undergoing hemodialysis. This condition can culminate in important physiological impairments, such as decreased systemic blood flow, arrhythmias, increased oxygen demand by the tissues, decreased metabolism, decreased platelet function, increased susceptibility to wound infection, among others[9].

No previous studies were found about the hypothermia nursing diagnosis accuracy in patients on hemodialysis. Thus, given the context presented here, the following questions arose: what is the prevalence of hypothermia in patients on hemodialysis? what are the defining characteristics that best predict the hypothermia nursing diagnosis in patients on hemodialysis?

This study may improve the nursing diagnosis hypothermia in NANDA-I, since it sought to highlight the most important defining characteristics of this diagnosis in a specific group, igniting scientific evidence that justifies listing chronic renal patients in the "at risk populations" belonging to this nursing diagnosis. Finally, it will provide nurses with evidence that can facilitate the inference of hypothermia in this group, enabling safe and effective decision-making that meets patients' needs.

OBJECTIVE

To analyze the accuracy of the defining characteristics of hypothermia in patients on hemodialysis.

METHODS

Ethical aspects

The local ethical committee in Brazil approved the study project. All research participants signed the Informed Consent Form before their participation after being verbally informed about the study objectives and the procedures involved.

Study design, period and place

A diagnostic accuracy study assembled within a cross-sectional study was carried out. Accuracy refers to the ability to discriminate between alternative health states, correctly differentiating individuals with and without a nursing diagnosis[10-11]. Thus, to carry out this study, a specific methodological framework was used to establish the accuracy of clinical indicators in predicting the nursing diagnosis[12]. The basis of this reference seeks to respond to two questions: the level of accuracy to which the information obtained represents the phenomenon under investigation, and the accuracy of the clinical reasoning process[12]. The STARD framework was used in this study[13].

Data collection was carried out between September 2019 and February 2020. The research was carried out in two dialysis centers in Brazil.

Population and sample

The study population consisted of patients on hemodialysis with chronic kidney disease assisted in the dialysis centers chosen for the study. The selected centers are philanthropic health care institutions that assist patients from the public and private network of the state of Ceará, Brazil. Initially, participants were approached by the researchers upon arrival at the centers, for their hemodialysis sections. After hearing about the study and accepting to participate, they were referred to a nursing office where they proceeded with a further explanation about the study and its stages. Then, the inclusion and exclusion criteria were applied, and written consent was given. All patients interested in participating in the study were selected, as they all met the established criteria, thus justifying the absence of the prototypical STARD diagram to report participant flow through the study.

The inclusion criteria were medical diagnosis of chronic kidney disease, being treated with at least three hemodialysis sessions per week of 3- or 4-hour each, and being aged 18 or older. The

exclusion criteria were having cognitive deficit and hemodynamic instability at the time of data collection. Deficit assessment was carried out using information provided by caregivers and health professionals from the multidisciplinary team, who monitor patients, and through their clinical observations.

The latent class model recommendations were adopted for determining the sample size[14]. For the sample calculation, the number of defining characteristics was considered and multiplied by the minimum number of patients required for each of these characteristics, i.e., 8 to 10 patients should be selected for each of the 13 defining characteristics of hypothermia. This strategy is used to determine the sample size in diagnostic accuracy studies based on latent class analysis[14-15]. The final sample size was composed of 124 patients. The sampling was consecutive and non-probabilistic.

Study protocol

The nursing diagnosis hypothermia has seven defining characteristics belonging to neonates and 16 belonging to the other groups. In adults, the defining characteristics acrocyanosis, bradycardia, cyanotic nail beds, decrease in blood glucose level, decrease in ventilation, hypertension, hypoglycemia, hypoxia, increase in metabolic rate, increase in oxygen consumption, peripheral vasoconstriction, piloerection, shivering, skin cool to touch, slow capillary refill, and tachycardia can be found[2]. The defining characteristics increase in metabolic rate, increase in oxygen consumption, and decrease in ventilation were excluded, due to the lack of equipment and supplies necessary for their assessment.

An instrument was created for data collection and included sociodemographic and clinical variables, and characteristics obtained through physical examination. These variables were collected and used as the basis for accuracy analysis. Moreover, a narrative literature review was carried out in scientific articles and books on physiology, semiology, and nephrology, through which conceptual and operational definitions of the defining characteristics of interest were created. These definitions underwent a content analysis by five members of the Research and Extension Group on Nursing Practice Classification Systems at a higher education institution.

The research group mentioned above comprises nurses with doctoral, master's and bachelor's degrees in nursing. The analysis of the definitions took place through one-to-one meetings, in which the examiners issued their comments on the clarity and applicability of the conceptual and operational definitions. All relevant suggestions were accepted. Therefore, all clinical information from the study participants was collected through the instrument constructed and assessed.

The study authors carried out the data collection procedure after carrying out a training with the main researcher to calibrate the team, minimize data collection bias, and promote familiarization with the instrument[12]. This training covered the approach of the clinical context, physiological and anatomical aspects of patients on hemodialysis, and the conceptual and operational definitions created for the study.

A pilot test with five patients was carried out to assess the instrument regarding its applicability and measurement, assuring the researchers that it was ready to be used for data collection. The instrument was applied through nursing consultations. Then, the instrument was reformulated in terms of its organization to make the anamnesis stage more fluid, in order to optimize the time spent on the assessments. For collecting clinical variables, the following equipment was used: an ear thermometer (Multilaser® - Touch Care HC116), a stethoscope (BIC®), an aneroid sphygmomanometer (BIC®), a digital finger oximeter (Multilaser® - OX-06 HC261), and a glucometer (Descarpack® - DG-Tech).

Analysis of results, and statistics

The data were organized in a Microsoft Office Excel 2013 spreadsheet and analyzed using the statistical package SPSS and the R software package. The data descriptive analysis included calculating absolute frequencies, percentages, central tendency measures, and dispersion measures. For the proportions of categorical variables, 95% confidence intervals were used. Measures of sensitivity (proportion of subjects with the nursing diagnosis for which an indicator is present) and specificity (proportion of subjects without the diagnosis for which an indicator is absent) of the defining characteristics were calculated using the latent class analysis method, using a random effects model.

Latent class analysis consists of a technique used to calculate accuracy measures of clinical indicators when there is no perfect reference standard, based on the assumption that an unobserved or latent variable (nursing diagnosis) determines the associations between observable variables (defining characteristics). A model of two latent classes with random effects was also used to calculate sensitivity and specificity values, with their respective 95% confidence intervals[16].

The random effects model assumes conditional dependence between the defining characteristics of the diagnosis under analysis. The likelihood ratio test (G2) was applied to verify the goodness-of-fit of the latent class model. The defining characteristics that did not present statistical significance were excluded, and a new model was adjusted. Statistical non-significance was considered when the upper limit of the confidence interval for sensitivity and specificity measures was less than 50% and/or when the confidence interval included this value.

The analysis of the association between the defining characteristics studied and variables of interest was established using the chi-square test for categorical data and Fisher's exact probability test. Nonparametric tests were applied to variables that did not follow a normal distribution (binomial test; sum of 53 Wilcoxon orders; Kruskal-Wallis test; Wilcoxon assigned rank test; and Friedman test).

RESULTS

One hundred twenty-four patients participated in this study, of which 66 (53.2%; 95%CI = 44.1-62.2) were female, 80 (64.5%; 95%CI = 55.4-72.7) had a partner, and 117 (94.4%; 95%CI = 88.3-97.5) claimed that they had hemodialysis-related complications before. Participants' average age was 54 years old (SD = 14.97), and the average education level was about six years old (SD = 4.34). The mean age ($p = 0.005$; IQR = 27.00), education ($p < 0.001$; IQR = 6.00), income ($p < 0.001$; IQR = 1.00) and hemodialysis time ($p < 0.001$; IQR = 5.75) were statistically different in the sample.

The Kolmogorov-Smirnov test showed an asymmetric distribution ($p < 0.05$) of age, education, income, and hemodialysis time.

The frequency and confidence interval of the defining characteristics of hypothermia are shown in Table 1. It can be observed that the most prevalent defining characteristics were hypoxia, decrease in blood glucose level, hypertension, piloerection, skin cool to touch, and slow capillary refill. Hypoxia was present in 100% of the sample.

Table 1 – Frequency and confidence interval of hypothermia and its defining characteristics concerning sociodemographic and clinical variables in patients on hemodialysis (N = 124)

Defining characteristics	n	%	95% CI[a]
Hypoxia	124	100.0	96.2 – 100.0
Decrease in blood glucose level	103	83.1	75.0 – 89.0
Hypertension	81	65.3	56.2 – 73.5
Piloerection	56	45.2	36.3 – 54.3
Skin cool to touch	51	41.1	32.5 – 50.3
Slow capillary refill	44	35.5	27.2 – 44.6
Hypoglycemia	23	18.5	12.3 – 26.7
Acrocyanosis	22	17.7	11.7 - 25.8
Peripheral vasoconstriction	18	14.5	9.1 – 22.2
Cyanotic nail beds	14	11.3	6.5 – 18.5
Bradycardia	11	8.9	4.7 – 15.7
Shivering	9	7.3	3.6 – 13.7
Tachycardia	7	5.6	2.5 – 11.7
Hypothermia	13	10.48	5.9 – 17.6

Variables	Hypothermia		OR	95% CI
	Present	Absent		
Sex				
Male	8 (6.5%)	50 (40.3%)	1.821	0.631 - 5.256
Female	5 (4.0%)	61 (49.2%)	0.933	0.824 - 1.056
Marital status				
With partner	9 (7.3%)	71 (57.3%)	1.238	0.404 - 3.788
Without partner	4 (3.2%)	40 (57.3%)	0.976	0.864 - 1.103
Complications				
Yes	12 (9.7%)	6 (84.7%)	0.718	0.108 - 4.762
No	1 (0.8%)	6 (4.8%)	1.047	0.768 - 1.425

[a]95% CI - 95% confidence interval; OR - Odds Ratio.

Table 2 – Diagnostic accuracy measures obtained from the latent class model in patients on hemodialysis (N = 124)

Defining characteristics	Se (%)	95% CI	Sp (%)	95% CI
Acrocyanosis	99.96	99.10 - 100.00	91.87	82.47 - 95.87
Cyanotic nail beds	99.98	99.45 - 100.00	99.07	1.39 - 99.98
Skin cool to touch	92.28	0.32 - 99.86	64.85	54.87 - 73.08
Shivering	46.24	20.77 - 75.59	97.29	49.50 - 99.84
Peripheral vasoconstriction	69.34	11.42 - 95.79	91.89	72.37 - 97.46
Prevalence: 10.48%	G^2: 10.06	DF: 20	p = 0.967	Entropy: 0.998

Se - sensitivity; Sp - specificity; G^2 - Likelihood Ratio; DF - Degrees of Freedom; 95% CI - 95% confidence interval.

Table 3 – Subsequent probabilities for hypothermia obtained from the latent class model in patients on hemodialysis

Set	Defining characteristics[a]					n	Hypothermia	
	DC1	DC2	DC3	DC4	DC5		Present	Absent
1	0	0	0	0	0	59	0.00	1.00
2	0	0	0	0	1	7	0.00	1.00
3	0	0	0	1	0	1	0.00	1.00
4	0	0	1	0	0	30	0.00	1.00
5	0	0	1	0	1	2	0.00	1.00
6	0	0	1	1	0	2	0.00	1.00
7	0	1	1	0	0	1	0.00	1.00
8	1	0	0	0	0	5	0.00	1.00
9	1	0	1	0	0	4	0.00	1.00
10	1	1	0	1	1	1	1.00	0.00
11	1	1	1	0	0	2	0.99	0.01
12	1	1	1	0	1	5	1.00	0.00
13	1	1	1	1	0	2	1.00	0.00
14	1	1	1	1	1	3	1.00	0.00

[a]DC1 - acrocyanosis; DC2 - cyanotic nail beds; DC3 - skin cool to touch; DC4 - shivering; DC5 - peripheral vasoconstriction.

Table 1 also shows the frequency of the nursing diagnosis hypothermia in relation to sex, education, and complications, as well as Odds Ratio (OR) and its respective confidence intervals. The chi-square test and Fisher's exact test did not indicate a statistically significant association between the diagnosis and sociodemographic and clinical variables (p> 0.05).

The accuracy measures of the defining characteristics of hypothermia are shown in Table 2. The nursing diagnosis was present in 13 (10.48%) study participants. The defining characteristics acrocyanosis (99.96%) and cyanotic nail beds (99.98%) had a high sensitivity. These defining characteristics were present when hypothermia was present.

Acrocyanosis was the defining characteristic that presented high values of sensitivity and specificity concomitantly. It should be noted that the defining characteristics acrocyanosis, skin cool to touch and peripheral vasoconstriction had high specificity.

Table 3 shows the probability of identifying hypothermia according to the latent class model.

The following five sets out of 14 sets with different combinations of defining characteristics were likely to present hypothermia: 10, 11, 12, 13, and 14. It is noteworthy that these combinations refer to the concomitant presence of given defining characteristics. The probability of identifying hypothermia was ten out of every one hundred patients.

DISCUSSION

The findings of this study are consistent with those observed in other investigations on this subject, in which most participants had a low level of education, low income, and reported hemodialysis-related complications[17-18]. Furthermore, most studies indicate a high proportion of men on hemodialysis[9,17], which can be explained by the low adherence of men to treatment of chronic diseases (such as diabetes and hypertension), and due to belated demand for health assistance.

Regarding sex and hypothermia, it is believed that women are less vulnerable to hypothermia, since they have more adipose tissue (a thermal insulator) than men, reducing heat loss, which may explain the low prevalence of hypothermia in female patients[9,19]. Still, about sociodemographic variables, a study on the association between nursing diagnoses and sociodemographic and clinical variables in patients on hemodialysis found a similar profile of patients, with a predominance of males, with a mean age of 46.6 years (± 12.3), 8.5 years (± 4.8) of education, and 62.9% people living with a partner[17]. Lack of awareness may cause delay in seeking health care, making renal patients more susceptible to kidney complications. It is assumed that income, lifestyle, food, and culture are factors that trigger kidney diseases, conferring vulnerability and compromising individuals' quality of life[17].

The nursing diagnosis hypothermia was present in 10.48% of participants, and hypoxia, decrease in blood glucose level, hypertension (65.3%), piloerection (45.2%), and skin cool to touch (41.1%) were the most prevalent defining characteristics. A previous study has found hypothermia in 61.8% of a sample of chronic renal patients undergoing hemodialysis[20].

Regarding decrease in blood glucose level, a study that assessed changes in the need for insulin in patients with type 2 diabetes on hemodialysis found a significant reduction in blood glucose levels 2 hours after dialysis compared to pre-dialysis levels[21]. Hypothermia is commonly followed by hypoglycemia and hypoinsulinemia. Disorders of glucose metabolism in these conditions are more profound, intensifying enzymatic reactions and increasing the energy demand of tissues[22]. Such information justifies the presence of a reduction in capillary glycemia as a defining characteristic in study participants.

Piloerection was also a defining characteristic prevalent in the sample. Although humans do not have this function, in animals, piloerection allows retaining "insulating air" close to the skin, causing the heat transfer to the environment to decrease significantly[23]. This signal indicates that patients are feeling cold and that the organism is trying to regulate body temperature and avoid heat loss to the environment.

As for hypertension, this is a frequent comorbidity in patients on hemodialysis (70-80%), and only a small proportion of patients are able to keep their blood pressure under control[24], which explains the high prevalence of hypertension in the present study. It is worth noting that hypertension and hypoglycemia, even though listed in the NANDA-I as defining characteristics of hypothermia, can be considered hemodialysis-related complications. In other words, these characteristics could also be listed as associated conditions of the hypothermia nursing diagnosis.

Concerning slow capillary filling, it is defined as a delay in the distal capillary refill time after nail bed compression. In healthy adults, this takes two to three seconds. In the case of hypothermia, this manifestation can be caused by peripheral vasoconstriction[9,25]. Regarding cold skin to the touch and peripheral vasoconstriction, they were shown as defining characteristics sensitive to hypothermia. A study pointed out that hypotonia, tachycardia, bradycardia, peripheral vasoconstriction, and other defining characteristics make up hypothermia, as our findings confirm[26].

About vasoconstriction, it is understood that exposure to cold stimulates heat production and conservation to protect the internal body temperature, obtained through reductions in skin blood flow[27]. Vasoconstriction prevents the circulation of a greater blood volume in the vessels, reducing cutaneous temperature, explaining the high sensitivity of the defining characteristics skin cool to touch and peripheral vasoconstriction found in the present study. Furthermore, these results confirm the findings of a previous study that reported that the main responses to hypothermia are cutaneous vasoconstriction, thermogenesis without shivering, shivering, and behavioral changes[28]. In this regard, it is assumed that peripheral vasoconstriction attempts to increase temperature, compensating for hypothermia.

Acrocyanosis and skin cool to touch had high specificity values. Acrocyanosis and cyanotic nail beds are events of peripheral cyanosis, defined as a blue-purple coloration of the body's extremities[29]. While acrocyanosis occurs in the hands, feet, and ears, cyanosis occurs in the toenails and nail beds of the hands, which may indicate hypoxia[9].

Cyanosis occurs due to an increase in reduced hemoglobin in capillary blood beyond 5 g% (the normal is around 2.6 g%), not being noticeable until blood oxygen saturation is below 85%[29]. Peripheral cyanosis signals a decrease in blood flow to the extremities (fingers and toes and earlobes), as in vasoconstriction, due to exposure to cold, not necessarily indicating a systemic response[30].

In other studies with cardiac patients and newborns, the defining characteristics decrease in blood glucose level, hypertension, hypoglycemia, piloerection, tachycardia, skin cool to touch, tachypnea, vasodilation, and apnea had high sensitivity values for hypothermia[9,26]. These studies also point out that the defining characteristics decrease in blood glucose level, hypoglycemia, hypertension, pallor, peripheral vasoconstriction, restlessness, bradycardia, tachycardia, hypotonia, irritability, slow capillary refill, and jaundice are specific for hypothermia[9,26].

Given the above, the importance of properly inferring nursing diagnoses through the investigation of sensitive and specific defining characteristics is reinforced, thus allowing the planning and implementation of quick and effective interventions to achieve satisfactory outcomes[26].

Studies on hypothermia in patients on hemodialysis should be encouraged to allow a better understanding of how this response and its clinical manifestations occurs in this population. The results discussed here may contribute to nursing care of patients on hemodialysis, providing important information about the defining characteristics that indicate hypothermia in this clientele.

It is recommended that further studies of diagnostic accuracy be carried out in patients on hemodialysis, considering the time of treatment and the presence of other comorbidities that may interfere with thermoregulation. Thus, new investigations that prove the susceptibility of chronic renal patients in hemodialysis to hypothermia are needed. Possibly, this group of patients could be included in the NANDA-I taxonomy as at risk populations of the hypothermia nursing diagnosis.

Study limitations

The generalization of our findings is subject to certain limitations, since the sampling was consecutive and non-probabilistic. Furthermore, the findings reported here cannot be extrapolated to all renal patients, since hypothermia was investigated in a specific public, reflecting the signs and symptoms common to it. However, the scarcity of studies involving the accuracy of hypothermia and its components, specifically in patients on hemodialysis, highlights the importance of this topic.

Contributions to nursing

Hypothermia is a relevant problem that can cause serious damage to patients, needing to be correctly identified and promptly solved. Such findings have significant implications for nursing assistance to patients on hemodialysis, because defining characteristics with high specificity and sensitivity can assist nurses in their reasoning and clinical judgment for the correct inference of hypothermia, making this process more accurate. The study findings may also improve the NANDA-I taxonomy, bringing a reflection on the need to include the population of patients on hemodialysis in the population-at-risk component of the hypothermia nursing diagnosis. Studies that provide a basis for accurate diagnostic inferences enable nursing care that is more targeted and consistent with patients' real needs.

CONCLUSION

This study demonstrated that hypoxia, decreased blood glucose level, hypertension, piloerection and skin cool to touch were the most frequent defining characteristic in a sample of patients on hemodialysis. Acrocyanosis was specific and sensitive for the hypothermia nursing diagnosis, which indicates that they are good clinical indicators for confirming this diagnosis. Also, other defining characteristics, such as cyanotic nail beds, had high accuracy values and, therefore, must be seen as important clues of the presence or absence of hypothermia.

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