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Prediction of risk and diagnostic accuracy in patients hospitalized for decompensated heart failure: cohort study

Predição de risco e acurácia diagnóstica em pacientes internados com insuficiência cardíaca descompensada: estudo de coorte

Predicción de riesgo y precisión diagnóstica en pacientes internados con insuficiencia cardiaca descompensada: estudio de cohorte

Carolina Mirapalheta Ernandes[a]
Daniela de Souza Bernardes[b]
Vanessa Monteiro Mantovani[c]
Leticia Lopez Pedraza[d]
Eneida Rejane Rabelo-Silva[a,b,c,d,e,f]

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ABSTRACT

Objectives: To analyze the diagnostic accuracy in nursing in patients with predicted risk of clinical worsening during hospitalization for acutely decompensated heart failure.

Methods: Cohort study with data collection in medical records according to the Acute Decompensated Heart Failure National Registry risk model. After defining the patients at risk, the Nursing Diagnosis Accuracy Scale version 2 was applied. The scale classifies the accuracy as null, low, moderate or high.

Results: Of the 43 patients at risk of worsening, 22 (51%) did not worsen and 21 (49%) worsened; in both, the diagnostic accuracy was in the Moderate / High category in 22 (89%) and 16 (88%), respectively. Only Decreased cardiac output and Excessive fluid volume were scored with 100% in the High category.

Conclusions: Patients with acute decompensated heart failure and risk of clinical worsening during hospitalization were identified with moderate or high diagnostic accuracy by nurses.

Keywords: Nursing diagnosis. Data accuracy. Heart failure.

RESUMO

Objetivos: Analisar a acurácia diagnóstica de enfermagem em pacientes com predição de risco de piora clínica durante internação por insuficiência cardíaca agudamente descompensada.

Método: Estudo de coorte com coleta de dados em prontuário de acordo com o Acute Decompensated Heart Failure National Registry risk model. Após a definição dos pacientes em risco, aplicou-se a Escala de Acurácia de Diagnósticos de Enfermagem versão 2. A escala classifica a acurácia em nula, baixa, moderada ou alta.

Resultados: Dos 43 pacientes com risco de piora, 22(51%) não pioraram e 21(49%) pioraram; em ambos, a acurácia diagnóstica apresentou-se na categoria Moderada/Alta em 22(89%) e 16(88%), respectivamente. Apenas Débito cardíaco diminuído e Volume de líquidos excessivo foram pontuados com 100% na categoria Alta.

Conclusões: Pacientes agudamente descompensados e com risco de piora clínica durante a internação foram identificados com acurácia diagnóstica Moderada ou Alta pelos enfermeiros.

Palavras-chave: Diagnóstico de enfermagem. Acurácia dos dados. Insuficiência cardíaca.

RESUMEN

Objetivos: Analizar la precisión diagnóstica enfermera en pacientes con predicción de riesgo de empeoramiento clínico durante su internación por insuficiencia cardiaca agudamente descompensada.

Método: Estudio de cohorte con colecta de datos em las historias médicas de pacientes con riesgo de empeoramiento clínico de acuerdo con la Acute Decompensated Heart Failure National Registry risk model. Después de la definición de los pacientes en riesgo, se aplicó la Escala de Precisión de Diagnósticos de Enfermería versión 2. La escala clasifica la precisión en nula, baja, modera o alta.

Resultados: De los 43 pacientes con riesgo de empeoramiento, 22(51%) no empeoraron y 21(49%) empeoraron; en ambos, la precisión diagnóstica se presentó en categoría Moderada/Alta en 22(89%) y 16(88%), respectivamente. Apenas Disminuición del Gasto cardíaco y Volumen de líquidos excesivo fueron puntuados con 100% en la categoría Alta.

Conclusiones: Pacientes con insuficiencia cardiaca agudamente descompensada y riesgo de peora clínica durante su internación fueron identificados con precisión diagnóstica Moderada o Alta por los enfermeros.

Palabras clave: Diagnóstico de enfermería. Exactitud de los datos. Insuficiencia cardíaca.

[a] Hospital de Clínicas de Porto Alegre (HCPA), Residência Integrada Multiprofissional em Saúde em Atenção Cardiovascular. Porto Alegre, Rio Grande do Sul, Brasil.

[b] Universidade Federal do Rio Grande do Sul (UFRGS), Escola de Enfermagem. Porto Alegre, Rio Grande do Sul, Brasil.

[c] Universidade Federal do Rio Grande do Sul (UFRGS), Escola de Enfermagem, Programa de Pós- graduação em Enfermagem. Porto Alegre, Rio Grande do Sul, Brasil.

[d] Universidade Federal do Rio Grande do Sul (UFRGS), Programa de Pós-graduação em Cardiologia e Ciências Cardiovasculares. Porto Alegre, Rio Grande do Sul, Brasil.

[e] Universidade Federal do Rio Grande do Sul (UFRGS), Escola de Enfermagem, Departamento de Enfermagem Médico-cirúrgica. Porto Alegre, Rio Grande do Sul, Brasil.

[f] Hospital de Clínicas de Porto Alegre (HCPA), Serviço de Cardiologia, Grupo de Insuficiência Cardíaca e Transplante Cardíaco. Porto Alegre, Rio Grande do Sul, Brasil.

INTRODUCTION

Acutely decompensated heart failure (ADHF) is defined as the abrupt onset or rapid change in clinical manifestations[1] that affects the quality of life of patients and increases hospital admission and mortality rates[2]. Due to these changes, it is important to implement any therapeutic measures in the first hours of admission to ensure a better in-hospital evolution[3]. Today, biomarkers, such as brain natriuretic peptide (BNP), are administered on admission for risk stratification. This marker is useful to establish the prognosis during the hospital stay and after discharge and to help draft an individualized treatment plan[1-4].

In this respect, the authors of an American study created and validated the Acute Decompensated Heart Failure National Registry (ADHERE) risk model to stratify the risk of in-hospital worsening in patients with ADHF. This risk prediction model identifies patients during admission who are at risk of in-hospital worsening. The instrument was able to predict a 15% risk of in-hospital worsening and provided a useful score for the health team[5].

In many reference centers, patient triaging in the emergency services or units is performed by nurses[3,6]. Therefore, it would be interesting if nurses were allowed to combine this score with their clinical assessment to support clinical reasoning and make a more accurate nursing diagnoses (ND). This justifies the need to use a scale for this purpose, such as the Nursing Diagnosis Accuracy Scale (EADE v. 2), developed and validated in Brazil. This instrument assess diagnostic accuracy during the period of hospitalization for ADHF[7].

In relation to ADHF, two NDs were studied and clinically validated in an emergency unit, namely decreased cardiac output[8] and fluid volume excess[9]. In addition to these diagnoses, the literature also provides data on the ineffective breathing pattern, often established for patients with ADHF[10].

It was in this context that the study was planned and the instruments were used (ADHERE risk model and EADE v. 2), since the use of instruments to predict the risk of clinical worsening in patients admitted with ADHF should support diagnostic accuracy and, consequently, clinical reasoning.

In this scenario of patients with ADHF and hospitalization, the previously established high mortality rate allows the implementation of approaches that predict risk and identify the most vulnerable patients. Consequently, this study was designed to associate the use of these two instruments, ADHERE risk model and EADE v.2 with the aim of answering the following research question: In patients for which the ADHERE risk model was able to predict the risk of in-hospital worsening, did the EADE provide a moderate or high degree of accuracy in the nursing diagnoses to indicate clinical deterioration during hospitalization? This study was conducted to answer this research question by analyzing the accuracy of the nursing diagnosis in patients with a predicted risk of clinical worsening during hospitalization for ADHF using two instruments, namely the ADHERE risk model and EADE v. 2.

METHOD

This is a cohort study with retrospective data collection using electronic health records from a database of 623 patients admitted for ADHF at a university hospital from 2013 to 2017. Data were collected from a database with variables of interest in this study. The variables were age, comorbidities (atrial fibrillation, coronary artery disease, chronic kidney disease, chronic obstructive pulmonary disease, diabetes mellitus, dyslipidemia, previous cerebrovascular accident or transient ischemic attack and history of tobacco use), blood pressure, heart rate, left ventricular ejection fraction, BNP, troponin, hemoglobin, sodium, urea and creatinine.

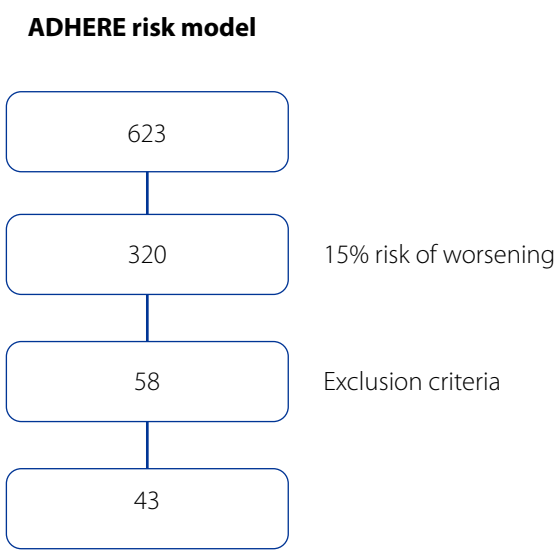
Inclusion criteria were patients admitted for ADHF, with preserved ejection fraction or not, result of BNP and risk of clinical worsening established by the ADHERE risk model. Exclusion criteria were absence of nursing records or NDs unrelated to ADHF in the first nursing assessment.

The ADHERE risk model was applied to the database sample of 623 patients in the first 24 hours of admission. The variables used in the score were initially analyzed, namely age, systolic blood pressure, heart rate, left ventricular ejection fraction, BNP/Pro BNP, troponin and sodium levels, urea and creatinine in the blood. With these data, a score was calculated for each patient and these values were divided into two groups: at risk of worsening and no risk of worsening. The criteria used for the at risk of worsening group were established according to the score: need for inotropic and vasodilator medication after 12 hours of admission, transfer to intensive care units or mechanical circulatory support therapy, ventilation mechanics and/or hemodialysis. The risk prediction model was calculated using the formula in the original study. This calculation is based on logistic regression analysis to predict the risk of in-hospital worsening, using a cut-off value of 15% of the original study[5].

In all, 320 patients at risk of worsening were identified. Of these patients, 58 were selected to further assess diagnostic accuracy using the EADE v. 2 based on a worsening risk prediction score of 15%. All the variables composing

the score of 58 patients were analyzed and the patients who got worse and the patients who did not get worse were subsequently divided.

All the NDs of these 58 patients with ADHF were reviewed. This review contained the following diagnoses: Decreased cardiac output, fluid volume excess, ineffective breathing pattern and ineffective tissue perfusion: cardiopulmonary[8-9] and risk for ineffective respiratory function[11]. At the end of this review, 15 only had the NDs risk of infection and self-care deficit, so they were excluded from the analysis. In all, 43 patients were included in this study.



Flowchart 1: Sample flowchart. Porto Alegre, RS, Brazil, 2017.

The EADE v. 2 was used to evaluate the diagnostic accuracy of the 43 patients selected using the ADHERE risk model. The NDs established in the first 24 hours of admission were entered into a Microsoft Excel spreadsheet and scored item to item, following the EADE v. 2.

The first item of the EADE v. 2 scale includes the item clues (1 point), the second scores the relevance of clues (high/moderate = 1 point), the third item points out the specificity of the clues (high/moderate = 3.5 points) and the fourth item scores the consistency of clues (high/moderate = 8 points). The score of each item was added to obtain the degree of accuracy of the ND, classified into four categories: Nil, low, moderate and high[7].

Electronic medical records of each patient were individually analyzed independently by two nurses previously trained by a nurse who specialized in EADE v.2 by way of a video conference. Later, the results were compared to validate data collection and prevent biases.

The outcome was the diagnostic accuracy defined by the EADE categorized as Nil, low, moderate or high. The NDs with a total score of zero were classified in the nil accuracy category and the NDs with a total score of one were classified in the low accuracy category. The NDs that scored between two and 5.5 were classified in the moderate accuracy category and the NDs with a score between nine and 13.5 were classified in the high accuracy category[7].

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. The categorical variables were described with absolute and relative frequencies, and continuous variables such as mean values and standard deviation or median and interquartile range were described based on whether they followed, or not, a similar distribution to the normal distribution. Pearson's chi-squared test was used to analyze the association between the results. The degree of concordance was calculated using the general Kappa coefficients. A value of $p<0.05$ was considered statistically significant.

This study was approved by the research ethics committee of the HCPA under opinion No. 1.984.504. All authors signed an attestation statement for the use of data obtained from medical records.

RESULTS

In all, 43 patients at risk of worsening for ADHF were analyzed. Of these records, 27 (63%) were men, white (86%), with an average age of 70 ± 8. Of these patients, 21 (49%) got worse and 22 (51%) did not get worse.

The most frequent etiology of HF was ischemic, 16 (37%), and the average left ventricular ejection fraction was 34 ± 14%. Of the co-morbidities, SAH was the most prevalent. The median length of stay was 9 (5-16) days and the in-hospital death rate was 7%. The data are presented in Table 1.

Table 2 illustrates the diagnostic accuracy of patients with risk prediction of worsening during hospitalization. In patients who got worse, 22 (88%) of the diagnoses were classified in the moderate/high accuracy category, similar to those who did not get worse (89%).

Table 3 shows the diagnoses divided between the patients who got worse and the patients who did not get worse. Decreased cardiac output, fluid volume excess, ineffective tissue perfusion: cardiopulmonary had the highest prevalence among the patients who got worse. Ineffective breathing pattern was present in 14 (52%) patients who did not get worse and risk for respiratory function was present in 2 (67%) patients who did not get worse.

The nurses established 46 diagnoses, in which three patients had more than one diagnosis. The most prevalent

diagnosis was ineffective breathing pattern in 27 (63%) of patients, followed by cardiac output decreased, with a prevalence of 7 (16%) and ineffective tissue perfusion: cardiopulmonary, observed in 7 (16%) patients. Subsequently, the diagnoses used were risk for ineffective breathing pattern and fluid volume excess in 3 (7%) and 2 (5%) patients, respectively. These data are shown in Table 4.

The degree of concordance among the researchers in the accuracy evaluation was 0.83. The diagnoses ineffective breathing pattern and ineffective tissue perfusion: cardiopulmonary had alternating categories of accuracy, but with a predominance in the high category. The NDs decreased cardiac output and fluid volume excess reached 100% in the high category. The ND risk for ineffective respiratory function was established in three patients and it was regarded as a nil accuracy category. Table 5 shows the accuracy of the established diagnoses.

Table 1 - Characteristics of the patients hospitalized for acutely decompensated heart failure. Porto Alegre, RS, Brazil, 2017.

Characteristics	n = 43
Age, years*	70 ± 8
Sex, male	27 (63)
Race, white	37 (86)
Length of stay, days†	9 (5-16)
In-hospital deaths	3 (7)
Etiology of HF, ischemic	16 (37)
Left ventricular ejection fraction (%)*	34 ± 14
Smoking	5 (12)
Coronary artery disease	15 (35)
Systemic arterial hypertension	31 (72)
Diabetes	22 (51)
Chronic kidney disease	14 (33)
Atrial fibrillation	18 (42)

ource: Research data, 2017.
Categorical variables expressed as n (%). * Continuous variables expressed as mean ± standard deviation
†Variables presented as median (25-75 percentile).

Table 2 - Diagnostic accuracy of patients with acutely decompensated heart failure in risk prediction. Porto Alegre, RS, Brazil, 2017.

Category of accuracy	Got worse	Did not get worse	*p-value
Low/Nil	3 (12)	2 (11)	NS
High/Moderate	22 (88)	16 (89)	NS

Source: Research data, 2017.
Categorical variables expressed as n (%); * Pearson's chi-squared test

Table 3 - Nursing diagnoses of patients with acutely decompensated heart failure related to worsening. Porto Alegre, RS, Brazil, 2017.

Nursing diagnosis	Got worse	Did not get worse
Decreased cardiac output	5 (71)	2 (29)
Fluid volume excess	2 (100)	0 (0)
Ineffective breathing pattern	13 (48)	14 (52)
Ineffective tissue perfusion: cardiopulmonary	5 (71)	2 (29)
Risk for ineffective respiratory function	1 (33)	2 (67)

Source: Research data, 2017.
Categorical variables expressed as n (%)

Table 4 - Nursing diagnoses of patients with acutely decompensated heart failure. Porto Alegre, RS, Brazil, 2017.

Nursing diagnosis	n = 46
Ineffective breathing pattern	27 (63)
Decreased cardiac output	7 (16)
Ineffective tissue perfusion: cardiopulmonary	7 (16)
Risk for ineffective respiratory function	3 (7)
Fluid volume excess	2 (5)

Source: Research data, 2017.
Categorical variables expressed as n (%)

Table 5 - Category of accuracy of the nursing diagnoses in patients with acutely decompensated heart failure. Porto Alegre, RS, Brazil, 2017.

Nursing diagnosis	Category of accuracy evaluator 1 n (%)	Category of accuracy evaluator 2 n (%)
Decreased cardiac output	High – 7 (100)	High – 7 (100)
Fluid volume excess	High – 2 (100)	High – 2 (100)
Ineffective breathing pattern	Nil – 1 (4) Low – 1 (4) Moderate – 4 (15) High – 21 (78)	Nil – 3 (11) Low – 2 (7) Moderate – 1 (4) High – 21 (78)
Ineffective tissue perfusion: cardiopulmonary	Nil – 2 (29) Low – 1 (14) High – 4 (57)	Nil – 2 (29) Low – 1 (14) High – 4 (57)
Risk for ineffective respiratory function	Nil – 3 (100)	Nil – 3 (100)

Source: Research data, 2017.

DISCUSSION

This study investigated the diagnostic accuracy of nursing in patients admitted for ADHF with a risk of worsening according to the ADHERE risk model. The results indicate that the patients who got worse and the patients who did not get worse had received diagnoses in the moderate/high accuracy category. The most prevalent ND was ineffective breathing pattern, related to congestion. This ND was similarly found in patients who got worse and in patients who did not get worse. The diagnoses of decreased cardiac output and fluid volume excess were more prevalent in the patients who got worse. The accuracy of the diagnoses ineffective breathing pattern, decreased cardiac output, fluid volume excess and ineffective tissue perfusion: cardiopulmonary were classified in the high category.

This study brings data from the diagnostic accuracy of nurses that evaluated patients with ADHF in the first 24 hours after admission. It is important to highlight that ADHF requires a careful evaluation in the first hours after admission and this evaluation is often carried out by nurses in emergency services[3]. This evaluation should address the signs of congestion or low output in order to rapidly impose measures that can reverse this acute condition and improve clinical in-hospital outcomes[6,12].

In this scenario, the classic signs of congestion and low output allow nurses to establish priority diagnoses in the patient evaluation[8-9]. Decreased cardiac output and fluid volume excess are already validated ND in patients with ADHF and cover most of the signs and symptoms of the patients admitted in emergency rooms. The clinical reasoning behind these diagnoses supports the determination of more assertive interventions and may contribute to better outcomes[8-9].

When the ND accuracy category is associated with the patients who got worse and the patients who did not get worse, it was observed that the nurses listed diagnoses of the moderate/high category. This indicates the nurses are alert to the signs and symptoms of congestion and can establish quicker and more effective interventions in the care of patients.

The ND decreased cardiac output was established in 16% of patients in this study. Although this diagnosis was established in a few patients, its diagnostic accuracy was considered high. The high degree of relevance, specificity and consistency of the clues agrees with studies that indicate decreased cardiac output is specific and priority for patients with ADHF[8-9]. The results of this study demonstrate the accurate clinical reasoning of nurses, corroborating data in the literature that confirms these professionals have the ability to make a reliable clinical evaluation and identify patients with congestive conditions or hypovolemic shock, as well as patients with low cardiac output[13].

Fluid volume excess was observed in only two patients (5%), corroborating studies that indicate this ND is a specific and priority diagnosis for patients with ADHF[9]. The related factor congestion was linked to the established diagnosis of ineffective breathing pattern. This diagnosis was also prevalent in a sample of patients with ADHF in a study conducted in the emergency room of the Hospital de Clínicas de Porto Alegre[10] and, although the establishment of this diagnosis was not accurate, the nurses used the appropriate clinical reasoning to identify the etiology of this diagnosis by relating it to congestion[10].

In this study, the clinically validated NDs for patients with ADHF[8-9] were not established as desired; however, when present, they had high accuracy scores. Finally, the results of this study suggest patients admitted for ADHF with a risk of in-hospital worsening were evaluated by nurses with diagnoses that indicated the clinical condition of congestion.

Limitations

The limitation of this study was the collection of secondary data. Variables such as experience or time of work with ND were not collected and may have influenced the diagnostic accuracy.

CONCLUSIONS

The results of this study show that the ND diagnoses established for patients admitted for ADHF and stratified as being at risk of worsening according to the ADHERE were categorized as moderate or high, regardless of whether they evolved to in-hospital worsening or not.

As an implication for clinical practice, ADHF is a major syndrome for patients and professionals and, consequently, requires a careful assessment primarily in the first 24 hours of admission. The establishment of accurate NDs could support effective interventions and satisfactory results during hospitalization.

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Corresponding author:
Eneida Rejane Rabelo-Silva
E-mail: eneidarabelo@gmail.com

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