Clinical evolution and survival of neurocritical patients*

Evolução clínica e sobrevida de pacientes neurocríticos

Evolución clínica y supervivencia de pacientes neurocríticos

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ABSTRACT

Objective: To evaluate the clinical evolution and survival of neurocritical patients in Hospital Units. **Method:** Cohort with hospitalized patients in follow-up treatment in public and private hospitals between September 2012 and June 2016. Data were initially analyzed from descriptive and inferential statistics. The Kaplan-Meier indicator was applied as a form of survival analysis. The Cox proportional hazards regression model was used to analyze the prognostic factors by calculating the hazard ratio. **Results:** Participation of 1,289 patients in the study. Patients with a higher score on the Glasgow Coma Scale presented greater survival, and the one-point increase in the scale score corresponded to 42% improvement in their survival. In the analysis of survival, sex and the use of vasoactive drugs showed a significant difference. **Conclusion:** Female patients with a better score on the Glasgow Coma Scale and using vasoactive drugs had higher survival rates.

DESCRIPTORS

Critical Care; Glasgow Coma Scale; Critical Care Nursing; Clinical Evolution.

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INTRODUCTION

Patients with insufficiency in one or more systems and involvement of the neurological state, are called neurocritical patients. Their main characteristic is the need for a constant health surveillance by the whole multiprofessional team[1].

Knowledge about the patient is essential, including the analysis of possible comorbidities by the health team at the time of care delivery, and it offers consistent data for better planning of care that influences the recovery of patients. Another important aspect is the severity of patients, since they normally have altered levels of consciousness, hemodynamic oscillation, are sedated or in use of vasoactive drugs (VAD) or other drugs for preserving stability, besides the invasive ventilatory support[2].

One of the relevant parameters to identify the worsening of patients with neurological damage is the level of consciousness. This assessment requires specific knowledge and preparation. The team should be able to analyze it with skill, precision and safety[3].

The Glasgow Coma Scale (GCS) is an effective form of assessment that defines the level of consciousness by observing behavior based on a numerical value. Its scoring system ranges between three and 15 and is based on the patient's best motor, verbal and ocular response. The higher the value the higher the level of consciousness, and the lower the level of severity, thereby reflecting a better prognosis. It is the most widely used scoring system internationally for the assessment of neurocritical patients in intensive care[4].

Care is needed in specific areas for addressing serious patients adequately and positively influencing the care and treatments provided. The Intensive Care Unit (ICU) is intended for the treatment of patients with constant instabilities, who require complex care and continuous monitoring. The use of appropriate technological equipment enables a better control of risk situations by health teams because of the fast decision making and agile interventions in critical situations[5].

In the ICU, patients need care from the whole health team through interconnected actions. Hence, there must be a close relationship between the entire multiprofessional team. Nursing plays an important role in the care of neurocritical patients. Actions should be based on the adequate promotion of cerebral perfusion and oxygenation, on hemodynamic control and early detection of the signs and symptoms resulting from the elevation or decompensation of intracranial pressure by preventing the worsening of secondary encephalic lesions[6].

Appropriate and accurate surveillance associated with the application of care plans and team interaction can contribute decisively throughout treatment and rehabilitation for preventing or detecting early complications. These patients have special challenges related to systemic disorders and intracranial processes that demand greater attention[6].

It is relevant to analyze the morbidity and mortality[7], and have knowledge of the profile of neurocritical patients and the many ways they are affected, as well as of factors influencing their survival. This has been addressed in national and international studies[7-9] by seeking specific answers for that particular group. Such analysis allows a multiprofessional care plan and the identification of patients' needs, thereby qualifying care[10].

Within this context, the aim of this study was to evaluate the clinical evolution and survival of neurocritical patients in hospital units.

METHOD

Study design

This is a descriptive, analytical, quantitative, cohort study.

Population

The study sample included 1,289 patients registered in public and private hospitals in the period between September 2012 and June 2016.

Selection criteria

Records of hospitalized neurocritical patients filed by the Organ Procurement Organization (OPO) team in public and private hospitals in the city of Petrolina (state of Pernambuco – PE) were included. The estimated population of the city is 331,951 people and it is 712 km far from the state capital, Recife[11]. The OPO initiates the follow-up of patients who have an GCS assessment equal to or lower than seven until the clinical outcome according to guidelines established in Ministerial Order number 2.600/2009, which approves the Technical Regulation of the National Transplant System[12].

The main objective of the OPO is the logistics organization of the organ and tissue donor procurement in hospitals located in their area of activity. These are defined by geographic and population criteria under the management of the State Transplant Center and the National Transplant System[12].

Data collection

Data collection took place between November 2016 and March 2017 through daily activity records of the OPO and supplementary information of the medical records. The sociodemographic variables collected in the study were age and sex. Regarding clinical conditions and evolution, the following factors were studied: cause of hospitalization, type of hospital (public or private), initial and final GCS value, days of hospitalization, use of vasoactive drug, sedation use and type. The outcome variables studied were clinical improvement and death.

The causes of hospitalization presented by patients in this study were divided into two categories: external causes (aggression, traffic accident, firearm injury, drowning,

exogenous intoxication, hanging/asphyxia, electric shock) and neurological causes (cerebrovascular accident – CVA, aneurysm, hydrocephalus, cerebral abscess, extradural hematoma, subdural hematoma, post-cardiorespiratory hypoxia, cerebral edema, meningitis and others).

ANALYSIS AND PROCESSING OF DATA

The evaluation of neurocritical patients' clinical condition and outcome was analyzed according to the classification of variables. Initially, we performed descriptive statistics with frequency distribution and measures of central tendency and dispersion. Confidence intervals of 95% (95% CI) were calculated for mean and proportion by assuming binomial distribution. The Kaplan-Meier indicator was applied as a form of analyzing the survival of neurocritical patients according to sex, cause of hospitalization and use of vasoactive drug.

The Cox proportional hazards regression model was used to analyze the prognostic factors by calculating the hazard ratio (HR) and the equivalent 95% confidence intervals[13]. By means of the significance obtained in the bivariate Cox model, were selected the variables, and those with a p-value lower than 0.20 were included in the multiple model. For the multiple model, p-values<0.05 were significant.

Data were presented in tables and graphs. The Microsoft Office Excel 2013 and the Stata 12.0 statistical software were used for the analysis of survival and prognostic factors.

ETHICAL ASPECTS

The study was approved by the Research Ethics Committee of the Universidade de Pernambuco and approved under Opinion number 1.686.219 on August 19, 2016. All ethical precepts established in Resolution number 466/2012 of the National Health Council, which addresses research with human beings, were followed. Since the source of data was secondary, there was no need to sign the Informed Consent form.

RESULTS

A total of 1,289 patients participated in the study. The mean age was 42.9 years. The mean GCS value found was four. The average length of hospitalization was of 5.1 days. From the 1,289 patients analyzed, 68.7% were male, the most prevalent cause of hospitalization was neurological with 54.5% of cases, 95.6% of hospitalizations were in public hospitals, and 50.7% of cases had clinical improvement. Regarding sedation, 74.1% used it, and Fentanyl and Midazolam were the most used drugs, corresponding

to 67.4%. In relation to the use of VAD, 64.5% did not use them (Table 1).

Table 1 – Distribution of patients' sociodemographic characteristics and clinical conditions (2012-2016) – Petrolina, PE, Brazil, 2016.

	Mean	SD	CI95%	
Mean age	42.9	21.6	41.7	44.1
GCS	4	1.6	4.2	4.4
Days of hospitalization	5.1	26.0	3.5	6.7
	N	%	CI95%	
Sex				
Female	389	31.4	28.8	33.9
Male	852	68.7	66.1	71.2
Cause of hospitalization				
Neurological causes	608	54.5	51.6	57.4
External causes	508	45.5	42.6	48.4
Type of hospital				
Public	1,226	95.6	94.5	96.8
Private	56	4.4	3.2	5.5
Patient's outcome				
Clinical improvement	651	50.7	48.0	53.4
Death	633	49.3	46.6	52.0
Used sedation				
No	954	74.1	71.7	76.5
Yes	334	25.9	23.5	28.3
Type of sedation				
Midazolam	20	14.8	8.7	20.9
Phenobarbital	1	0.7	-0.7	2.2
Fentanyl + Midazolam	91	67.4	59.4	75.4
Fentanyl	23	17.0	10.6	23.5
Use of VAD				
No	767	64.5	61.7	67.2
Yes	423	35.6	32.8	38.3

Patients with a higher GCS value had higher probability of survival. There was a 42% increase in patient survival at each point increase in this scale (HR = 1.42; 95% CI 1.32-1.52). For this model, sex, age, diagnosis and type of hospital did not present significant influence on survival (Table 2).

Table 2 – Crude and adjusted hazard ratios of variables of the final multivariate model – Petrolina, PE, Brazil, 2016.

	Crude HR	p-value	CI95%		adjusted HR	p-value	CI95%	
Sex								
Male	1.41	0.002	1.13	1.77	1.16	0.297	0.88	1.54
Female	1.00				1.00			
Age	1.00	0.232	1.00	1.01				
Diagnosis								
External causes	1.20	0.097	0.97	1.48	0.92	0.508	0.72	1.18
Neurological	1.00				1.00			
GCS	1.40	0.000	1.31	1.49	1.42	0.000	1.32	1.52
Hospital								
Private	0.53	0.040	0.29	0.97	0.53	0.066	0.27	1.04
Public	1.00				1.00			

When analyzing the Kaplan-Meier indicators for the survival of neurocritical patients, sex and the use of VAD showed a significant difference. Men had lower survival rates compared to women, and the use of VAD was also important for the clinical improvement of neurocritical patients (p<0.05). The causes of hospitalization, either neurological or external causes, did not have significant influence (Figures 1, 2 and 3).
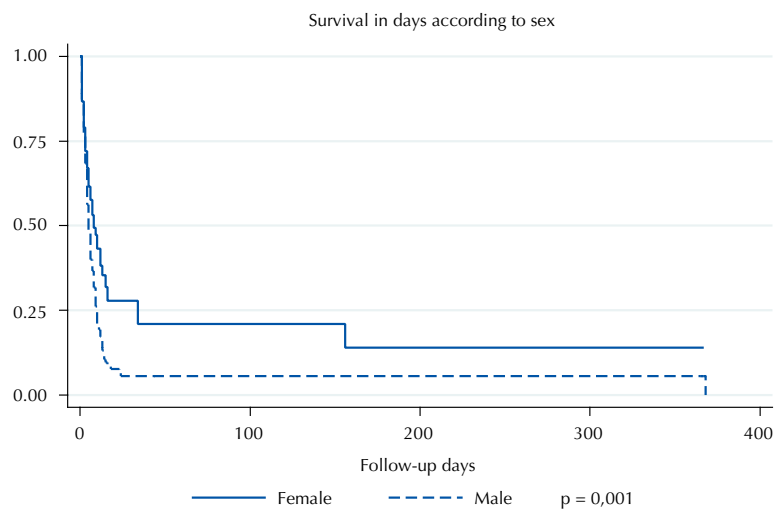

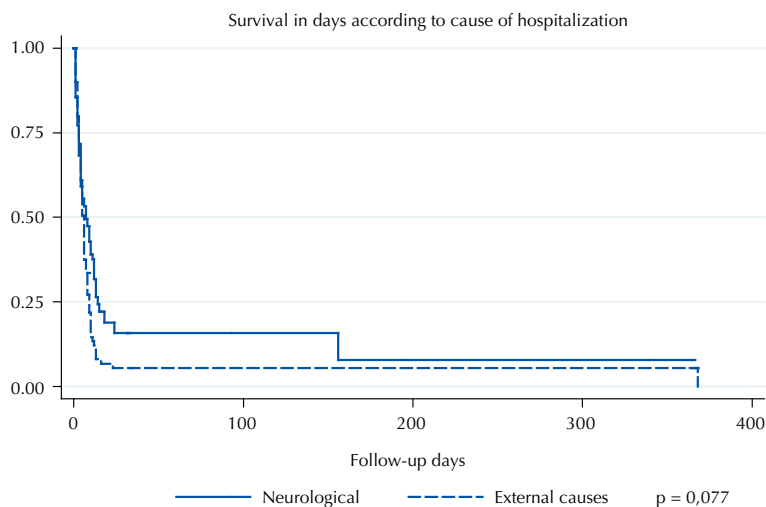**Figure 1** – Survival curve according to sex – Petrolina, PE, Brazil, 2016.

Figure 2 – Survival curve according to cause of hospitalization – Petrolina, PE, Brazil, 2016.
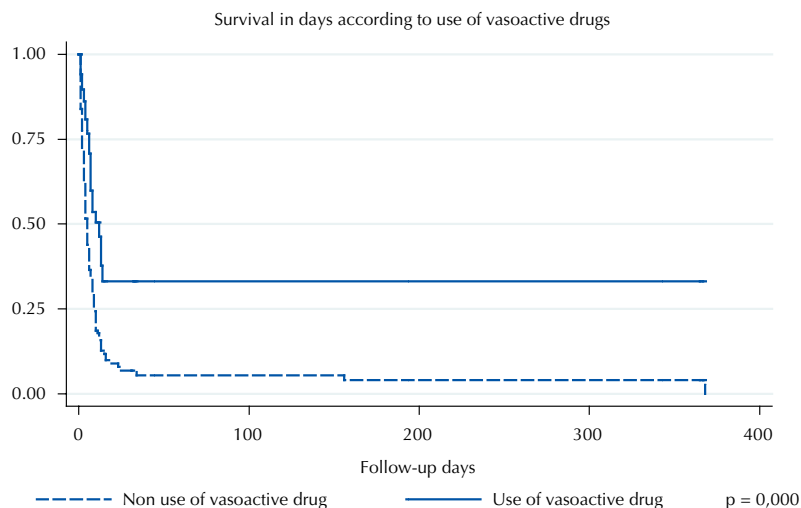
Survival in days according to use of vasoactive drugs

Figure 3 – Survival curve according to use of vasoactive drugs – Petrolina, PE, Brazil, 2016.

DISCUSSION

The characterization of neurocritical patients allows establishing objective criteria for clinical improvement and the targeting of nursing care and of other professionals directly related to patient care.

The male sex predominated, and this corroborates studies performed in ICUs in Fortaleza-CE and Porto Alegre-RS, where higher percentages of hospitalizations were found in men[2,14]. Another study carried out with neurocritical patients in Mexico showed that 53% of them were male[15]. Although there were more hospitalizations of men, a higher survival rate was observed among women ($p<0.05$). The hazard ratio did not present a significant difference for sex.

These data indicate a greater vulnerability of the male population to the causes of hospitalizations. The reasons can be cardiovascular diseases, because men often fail to control the risks, or given their greater exposure to risk factors associated with trauma, possibly due to their lifestyle or sociocultural context[16-17].

In the present study, were selected two categories of causes of hospitalization, namely neurological causes and external causes, because these were the most prevalent and given the characteristic of hospitals in the region. The hospital network of Petrolina has two public reference hospitals, one in trauma-orthopedics, neurology and neurosurgery, and the other in high-risk maternal and child health. Both attend the interstate health network of Pernambuco/Bahia (Portuguese acronym: PEBA), which comprises the Macroregion of the Middle Valley of São Francisco and covers 55 municipalities and a population of approximately 1.9 million inhabitants[18].

In a study conducted in Chile, the percentage of neuro-critical patients who entered the ICU was 26.8%, and this was the main form of hospital admission[19]. Another study conducted in the ICU of a private general hospital in São Paulo showed that 14% of patients hospitalized in this sector were neurological[20]. A similar result was found in a study conducted at the University Hospital of Fortaleza-CE, in which the percentage corresponded to 16%[21]. A study in

a public hospital located in Florianópolis-SC showed that among causes of ICU admission, external causes corresponded to 21.3%[5].

Regarding age, the mean found was of 42.9 years. A similar result was found in a study conducted in a neurological ICU in Teresina-PI, where the mean age of inpatients was of 37 years for men and 47 years for women[22]. In another study, were classified the causes of hospitalization in intensive care patients. The most prevalent causes found were the neurological (31%), followed by trauma (19%), and the predominant age range was of 58-73 years. Adults and elderly people have a higher prevalence of hospitalizations due to neurological causes, probably related to the presence of comorbidities, which triggers pathological processes or aggravates preexisting ones[23].

Regarding external causes, according to a study conducted in Jequié-BA, young adults are the majority, which may be related to the greater exposure of this age group to car accidents, aggressions, suicide attempts and drownings[17]. These causes can trigger neurological damage of various levels of severity that require meticulous evaluation and care. When analyzing patients' survival according to cause, this factor was not considered significant in determining survival ($p > 0.05$).

The identification of neurological dysfunctions and the follow-up of the evolution of patients' level of consciousness allow the prediction of prognosis and standardization of language among health professionals. This assessment is performed worldwide through the GCS[24]. Values below eight are classified as comatose patients, and values between three and four as deep coma[4]. The assessment of patients in this study followed the classification criteria set forth above.

A new classification is being adopted and performed according to criteria defined in a standard and structured sequence. If patients' components meet the criteria for scoring each measured behavior, the appropriate classification is allocated. If the response to a particular behavior cannot be assessed, this will be classified as "non-testable" and recorded as "NT"[25].

In the present study, the assessment through GCS had an average value of four. Such a score shows that most patients were in a deep coma. This is due to the profile of studied patients, neurocritical with greater physical and neurological involvement, and shows the severity in their hospitalization trajectory.

The National Supplementary Health Agency (Portuguese acronym: ANS – *Agência Nacional de Saúde Suplementar*) states the coverage rate of private health insurance plans in the state of Pernambuco is between 10 and 20%[26]. This corroborates the high percentage of hospitalized patients in public hospitals found in this study. Another determining factor for this higher percentage is the Mobile Emergency Care Service (Portuguese acronym: SAMU – *Serviço de Atendimento Móvel de Urgência*) that refers patients to public hospitals.

The length of stay in the ICU and evolution of patients are directly related to the severity of their disease[27]. A study conducted in Anápolis-GO shows the average time of hospitalizations in adult ICUs was of 7.6 days, which approaches the average of 5.1 days found in the present study[16].

Patients exposed to prolonged periods of hospitalization are subject to complications, such as infectious conditions in the various systems and pressure injuries. Hence, it is imperative monitoring the state of those in need of specific care, for their best evolution.

The aim of patient care is to improve their clinical outcome, but in some cases, this evolution does not occur as expected. The estimate of clinical outcome of death was of 49.3% of cases. A similar percentage was found in a study developed in the ICU of a public hospital, where the main outcome was death and accounted for 49.8%[10] of cases. The higher probability of this clinical outcome (death) is mainly a result of the poor general condition of these patients, as assessed through the GCS.

The present study showed a greater probability of survival of patients with a higher GCS value. Throughout their evolution course, the one-point increase in the score increases their survival by 42% (HR = 1.42). The team should seek to reestablish patients' neurological condition, since the improvement of the level of consciousness increases the probability of survival.

Sedation has become an integral part of intensive care practice for minimizing patient discomfort in the ICU. This practice decreases stress response, provides anxiolysis, and improves tolerance to ventilatory support[28]. In a study conducted at the Sírio-Libanês Hospital in São Paulo, was found a percentage of 13.2% of sedation use, which is in line with the percentage of 25.9% found in the present study[29].

Vasoactive drugs are routinely applied in the ICU in critically ill patients with important hemodynamic changes, because they act on blood vessels by causing vasodilatation or vasoconstriction, depending on the intended action and clinical condition of the patient[2]. In a study conducted in Hospital Santo Antônio, in Salvador-BA, 28.6% of patients were using VADs, thereby corroborating the results of the present study[30]. In the survival analysis, the use of VADs in the present study was significant for the clinical improvement of neurocritical patients (p < 0.05), and those who used these drugs presented greater survival.

Serious changes in one or more physiological systems often affect intensive care patients. The aim of including vasoactive agents in the care of patients with severe perfusion disorders is correcting peripheral, pulmonary or cardiac vascular alterations in order to restore the supply of nutrients and oxygen to the tissues and harmonize the metabolic demands[27]. The use of VAD is of vital importance for reversing patients' hemodynamic instability and improving their prognosis and survival.

The limitations of this study were the difficulties found in the standardization of terms used by the OPO for variables such as sedation and cause of hospitalization, and the few medical records found for the collection of other sociodemographic variables and of clinical evolution.

Based on the findings, it is key that nurses know the determinant factors in patient survival and provide feedback for the OPO, since this particularly optimizes the organ donation process through the active search performed daily by nurses. The uninterrupted follow-up of patients and the indicators defined by the OPO favor the formation of strategies that aim at the constant evolution of the organ donation process and good behavior in the treatment of neurocritical patients[31].

CONCLUSION

The findings of this study showed that the clinical evolution and survival of patients depend on factors such as sex, GCS score and the use of VAD. With this information, the multiprofessional team can provide specific and effective care for patients and achieve their clinical improvement and higher survival rates.

The relevance of this study also lies in the characterization of the sociodemographic profile of neurocritical patients, their evolution and outcome by bringing an innovative method through which patient survival can be evaluated according to some variables, isolated or associated. The combination of prevention actions and improvement of therapeutic measures can improve survival and consequently, reduce mortality from neurological disorders and external causes.

RESUMO

Objetivo: Avaliar a evolução clínica e sobrevida de pacientes neurocríticos em Unidades Hospitalares. **Método:** Coorte com pacientes acompanhados no período de setembro de 2012 a junho de 2016, internados em hospitais públicos e privados. Os dados foram analisados inicialmente a partir da estatística descritiva e inferencial. Como forma de análise da sobrevida, foi aplicado o indicador de Kaplan-Meier. O modelo de regressão para riscos proporcionais de Cox foi empregado para a análise dos fatores prognósticos,

calculando-se a razão de risco. **Resultados:** Participaram do estudo 1.289 pacientes. Os que possuíam Escala de Coma de Glasgow com maior valor apresentaram maior sobrevida, e o incremento de um ponto no escore dessa Escala correspondeu a uma melhora de 42% em sua sobrevida. Na análise de sobrevida, o sexo e o uso de drogas vasoativas mostraram diferença significativa. **Conclusão:** Pacientes do sexo feminino, que possuem melhor escore da Escala de Coma de Glasgow e em uso de drogas vasoativas apresentaram maior sobrevida.

DESCRITORES

Cuidados Críticos; Escala de Coma de Glasgow; Enfermagem de Cuidados Críticos; Evolução Clínica.

RESUMEN

Objetivo: Evolución clínica y supervivencia de pacientes neurocríticos en Unidades Hospitalarias. **Método:** Cohorte con pacientes seguidos en el período de septiembre de 2012 a junio de 2016, en estancia en hospitales públicos y privados. Los datos fueron analizados inicialmente mediante la estadística descriptiva e inferencial. Como modo de análisis de la supervivencia, se aplicó el indicador de Kaplan-Meier. El modelo de regresión para riesgos proporcionales de Cox fue empleado para el análisis de los factores pronósticos, calculándose la razón de riesgo. **Resultados:** Participaron en el estudio 1.289 pacientes. Los que tenían Escala de Coma de Glasgow con mayor valor presentaron mayor supervivencia, y el incremento de un punto en el score de dicha Escala correspondió a un mejora del 42% en su supervivencia. En el análisis de supervivencia, el sexo y el uso de drogas vasoactivas mostraron diferencia significativa. **Conclusión:** Pacientes del sexo femenino que tienen mejor score de la Escala de Coma de Glasgow y en uso de drogas vasoactivas presentaron mayor supervivencia.

DESCRIPTORES

Cuidados Críticos; Escala de Coma de Glasgow; Enfermería de Cuidados Críticos; Evolución Clínica.

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