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ORIGINAL

Prognostic scale for death in critically ill cancer patients due to neurological complications

Escala pronóstica de muerte para pacientes oncológicos críticos debido a complicaciones neurológicas

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ABSTRACT

Introduction: the scales used to predict death in cancer patients are scarce and have not been adequately validated in populations with neurological complications.
Objective: to design a prognostic scale for death in critically ill cancer patients due to neurological complications.
Method: an observational, prospective cohort study was conducted from January 2017 to 2024 in the Oncology Intensive Care Unit of the Institute of Oncology and Radiobiology in Havana, Cuba. The study population consisted of 265 patients. Clinical, oncological, laboratory, and life support variables were studied. Binary logistic regression analysis was used to determine the variables with the best prognostic power for the model. The final variable was mortality in the Intensive Care Unit.
Results: the final model consisted of the following variables: ECOG III (OR: 3,62; 95 % CI: 1,05 - 12,46; p= 0,041), absence of pupillary reflex (OR: 9,35; 95 % CI: 2,24 - 38,99; p= 0,002), intracranial hypertension (OR: 17,91; 95 % CI: 3,02 - 105,91; p= 0,001), hyperglycemia (OR: 5,85; 95 % CI: 2,07 - 16,49; p= 0,001), hypoxemia (OR: 19,09; 95 % CI: 2,91 - 61,67; p= 0,000) and artificial mechanical ventilation (OR: 9,59; 95 % CI: 2,59 – 35,51; p = 0,001).
Conclusions: the prognostic score classified mortality into 3 risk groups: low (0 to 2 points), moderate (3 to 6 points), and high (7 to 13 points). Mortality was higher in patients with higher scores. Internal validation showed excellent calibration and discrimination.

Keywords: Neurological Complications; Mortality; Cancer; Solid Tumors; Prognosis; Risk Factors; Mechanical Ventilation; Intracranial Hypertension.

RESUMEN

Introducción: las escalas utilizadas para predecir la muerte en pacientes con cáncer son escasas y no han sido adecuadamente validadas en poblaciones con complicaciones neurológicas.
Objetivo: diseñar una escala pronostica de muerte para pacientes oncológicos críticos debido a complicaciones neurológicas.
Método: estudio observacional, prospectivo de cohorte desde enero de 2017 hasta 2024 en la Unidad de Cuidados Intensivos Oncológicos del Instituto de Oncología y Radiobiología de la Habana, Cuba. La población de estudio estuvo conformada por 265 pacientes. Se estudiaron variables clínicas, oncológicas, de laboratorio y soporte vital. A través del análisis de regresión logística binario se determinaron las variables con mejor poder pronóstico para el modelo. La variable final fue la mortalidad en la Terapia Intensiva.
Resultados: el modelo final quedó constituido por las variables: ECOG III (OR: 3,62; CI 95 %: 1,05 - 12,46; p= 0,041), ausencia de reflejo pupilar (OR: 9,35; CI 95 %: 2,24 - 38,99; p= 0,002), hipertensión intracraneal (OR: 17,91; CI 95 %: 3,02 - 105,91; p= 0,001), hiperglucemia (OR: 5,85; CI 95 %: 2,07 – 16,49; p= 0,001), hipoxemia (OR: 19,09; CI 95 %: 2,91 – 61,67; p= 0,000) y ventilación mecánica artificial (OR: 9,59; CI 95 %: 2,59 – 35,51; p= 0,001).
Conclusiones: la escala pronóstica clasificó la mortalidad en 3 grupos de riesgo: bajo (0 a 2 puntos), moderado (3 a 6 puntos) y alto (7 a 13 puntos). La mortalidad fue mayor en pacientes con puntuaciones más elevadas. La validación interna presentó una excelente calibración y discriminación.

Palabras clave: Complicaciones Neurológicas; Mortalidad; Cáncer; Tumores Sólidos; Pronóstico; Factores de Riesgo; Ventilación Mecánica; Hipertensión Intracraneal.

INTRODUCTION

Clinical outcomes after a neurological emergency are worse for patients with cancer and can lead to critical illness requiring admission to the intensive care unit (ICU). Conditions such as stroke, coma, intracranial hypertension (ICH), and the need for mechanical ventilation (MV) are the subject of debate due to their uncertain prognosis. Recent research reports that the frequency of ICU admissions for neurological reasons in cancer patients varies between 3 % and 23 %, with mortality rates as high as 55 %. However, the evidence supporting this claim is complex, as studies are based on the authors' own experience and are case reports or series with a small number of patients. Nevertheless, as in neurocritical populations without cancer, mortality is high.[1,2,3]

It is crucial to identify clinical signs indicative of severity. From a neurological and evolutionary point of view, these are associated with a poor prognosis.[1] Predicting death is important for the treatment of critically ill cancer patients. Predictive models used in critical care medicine were developed in general populations, so their use in subpopulations is not appropriate without validation studies. Such studies are insufficient in cancer patients admitted to the ICU and have limitations that hinder their generalization.

Prognosis scales exist for various neurological complications, but specific models for neurocritical illnesses in the context of oncological intensive care are lacking. Therefore, existing scales for specific diseases may not be generalizable to patients with oncological neurological diseases. They may even lack generalizability within the disease population for which they were developed. This again highlights the need to communicate uncertainty when estimating prognosis. [5] The objective of this research was to design a prognostic scale for death in critically ill cancer patients due to neurological complications.

METHOD

A prospective, single-center cohort study was conducted in the oncology intensive care unit (OICU) of the Institute of Oncology and Radiobiology (IOR) in Havana, Cuba, from January 2007 to January 2024. The UCIO/IOR is a specialized unit with 12 beds that receives approximately 350 patients per year with clinical and surgical diagnoses. The research complied with the guidelines for observational studies STROBE[6] and on prognostic models TRIPOD.[7] It was previously approved by the institutional Scientific Council and the Ethics Committee. A total of 287 patients who required care at the UCIO/IOR for neurological reasons were included. Twenty-two patients who did not meet the inclusion criteria were excluded. The study population consisted of 265 patients. Inclusion criteria: age over 18 years; clinical, imaging, or laboratory diagnosis (or a combination thereof) of a neurological complication regardless of histological classification, tumor location, or clinical stage of cancer, with a stay in the ICU/IOR of more than 24 hours. Clinical variables: age, sex (male/female), presence of comorbidities, *performance status* one month prior to admission to the ICU (according

to the *Eastern Cooperative Oncology Group [*ECOG] classification[8] and origin of the patient (Oncology Emergency Unit [OUU] / Hospital admission). Oncological variables: Tumor location (CNS/Head and Neck [H&N]/Lung/Breast/Gastric/Colon/Hematology/Gynecology/Urology/Soft tissue/Primary unknown). Cancer stage according to TNM classification. Presence of metastasis (cerebral/extracerebral).[8] Chemotherapy or radiotherapy (QTP/RTP) 3 months prior to the neurological event. Neurological variables: neurological manifestations that occurred alongside the neurological complication were described, such as: Coma (absence of conscious awakening according to the Glasgow Coma Scale). Seizures. Severe motor deficit. Severe acute encephalopathy (variable combination of confusion, behavioral abnormalities, altered level of consciousness, and evidence of focal or diffuse neurological signs or symptoms regardless of cause).[9,10] Respiratory arrhythmia (Cheyne-Stokes / Neurogenic hyperventilation / Apneic breathing / Kussmaul / Ataxic). Pupillary light reflex abnormalities (absence of photomotor or consensual reflex / anisocoria / bilateral miosis / bilateral midriasis / pupillary unresponsiveness). Brain stem reflex abnormalities (according to the *Brainstem Reflexes Assessment Sedation Scale [*BRASS]).[11] Presence of intracranial hypertension ([ICH] according to records or by ultrasound measurement of the optic nerve sheath diameter [≥5,0 mm]).[12] Cerebral edema (diagnosed by computed tomography [CT]). Diagnosis on admission: (Ischemic or hemorrhagic stroke / Metabolic encephalopathy / Status epilepticus / Complicated postoperative neurosurgery for tumor / Other (CNS infection / Subdural hematoma / Hypertensive encephalopathy / ICH / Brain metastasis). Variables related to life support in the ICU: Hyperglycemia (blood glucose measured greater than 10 mmol/l). Hypoxemia (presence of peripheral oxygen saturation ≤88 % or partial oxygen pressure in blood sample ≤85 % regardless of oxygen and/or ventilatory support value, for at least one minute). Presence of invasive mechanical ventilation. The Glasgow Coma Scale (GCS) score on admission, APACHE II, length of stay with mechanical ventilation, and length of stay in the ICU were also studied. The primary outcome variable was mortality within the ICU. Categorical variables are shown as absolute frequencies and percentages. Numerical variables are shown as mean and standard deviation. The difference between groups (univariate analysis) was explored using Pearson's chi-square test (x^2) for categorical variables. And mean difference test for numerical variables. All statistical hypothesis tests were considered significant for a p-value ≤ 0,05. Statistical analysis was performed using IBM▫ r SPSS▫ version 23 (IBM, Armonk, NY, USA).

Predictive Scale Design

With the selected RLB model, the predictive scale was created by taking the beta coefficients (ß) of each predictor and converting them into integers:[3] 1) The logistic regression coefficients, *β,* were estimated. 2) The risk factors were organized into categories, *and* the reference category and W code were determined for each category. In the case of qualitative variables, W = 0 for the reference category and 1 for the rest of the categories. For quantitative variables, W is the mean of the variable within each category. 3) In terms of regression units, the distance between each category and the reference category was determined, given by: *β (*W – *Wref)*; where *β* is the logistic regression coefficient; W is the code for category i; and *Wref* is the code for the reference category. 4) The base constant was set, which is the smallest value *of β (*W – *Wref)*. 5) The number of points for each category of each variable was determined by dividing each value *of β (*W – *Wref)* by the base constant. After constructing the scale, the RLB model was adjusted and tested through calibration and discrimination. The highest *Youden* index (sensitivity + specificity−1) was identified, which determined the highest sensitivity and specificity together. To divide the categories of the predictive scale created. A minimum, intermediate, and maximum score was obtained, classifying the probability of death into three groups: low, high, and very high. The overall performance of the scale was evaluated using the R^2 statistic, calibration with the Hosmer-Lemeshow test, and discrimination with the AUC.

RESULTS

We studied 265 patients with solid tumors who were admitted to the ICU for severe neurological complications, of whom 98 (37 %) died. Table 1 shows the clinical-oncological characteristics and the results of the independence test. Only those who died from the OAU (p=0,000), those with comorbidities (p=0,01), an ECOG III classification (p=0,00), and those who had received prior QTP/RTP (p=0,01) showed a significant association with mortality in the univariate analysis.

Figure 1 shows the primary location of the tumors in the patients studied. The highest percentage of deaths was estimated in patients with colon and head and neck cancer, both with 13 patients (4,9 %). In the univariate analysis, the primary location was statistically significant (p= 0,000). However, a subanalysis of the data obtained shows that patients with CNS tumors had a higher proportion among the living than the rest of the patients (70 living patients and 9 deceased). For this reason, it was assumed that this statistical significance was associated with survival.

Table 1. Univariate analysis for mortality of clinical and oncological variables

Variables	Discharge				Total (n=265)		p
	Alive (n=167)		Deceased (n=98)				
	Nº	%[a]	Nº	%[a]	Nº	%[a]	
Sociodemographic							
Age (years)[b]	57,5±15,85		60,4±15,6		58,5±15,8		0,147
Sex							0,293
Male	69	26	47	17,7	116	43	
Female	98	37	51	19,2	149	56,2	
Source							0
UUO	34	12.	45	17	79	29,8	
Hospital	133	50,2	53	20	186	70,2	
Comorbidity	63	23.	52	19,6	115	43,4	0,015
ECOG							
0	14	5,3	0	1,9	19	7	0,318
I	40	15,1	17	6,4	57	21,5	0,206
II	38	14,3	27	10,2	65	24,5	0,381
III	16	6,0	29	10	45	17,2	0,000
IV	02	0,8	07	2,6	09	3,4	0,01
Oncological							
TNM							
I	54	20,4	18	6,80	72	27,2	0,140
II	65	24,5	24	9,10	89	33,6	0,160
III	18	6,80	27	10,2	45	17	0,000
IV	30	11,3	29	10,9	59	22,3	0,028
Metastasis							0,171
Cerebral	1	7,2	13	4,9	32	12,1	
Extracerebral	18	6,8	18	6	36	13,3	
QTP/RTP	61	23	56	21,1	117	44,2	0

[a] calculated based on the total. [b] mean±SD (standard deviation). ECOG: *Eastern Cooperative Oncology Group*. QTP/RTP: chemotherapy/radiotherapy

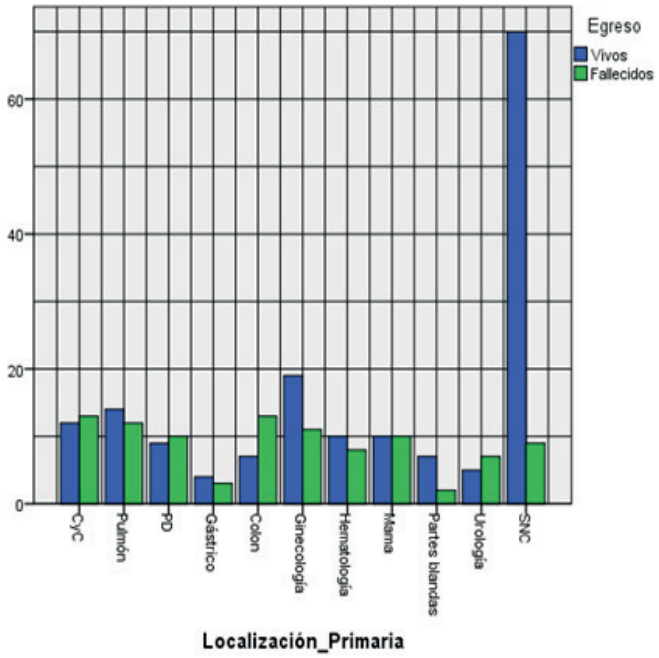

Figure 1. Primary location of the solid tumor

Table 2 shows the neurological manifestations that characterized neurological complications. Except for the presence of seizures (p=0,771), the rest of the variables studied were statistically significant for mortality

(p=0,000). In relation to neurological complications, only the presence of metabolic encephalopathy was statistically significant (p=0,000). Among extraneurological complications, only the presence of electrolyte imbalance was not statistically significant (p=0,823). The average between the groups studied in relation to the length of stay on AMV and in the general ICU was statistically significant (p=0,000 and 0,003, respectively). The APACHE II scale discriminated well for mortality (ACOR: 0,84; 95 % CI: 0,799–0,894; p=0,000).

Table 2. Univariate analysis for mortality from severe neurological manifestations, neurological complications, and extraneurological complications

Variables	Discharge				Total (n=265)		value p
	Alive (n=167)		Deceased (n=98)				
	Nº	%[a]	Nº	%[a]	Nº	%[a]	
Severe neurological manifestations (one or more)							
Coma	19	7,2	63	23,8	82	30,9	0
Seizures	12	4,5	0	3	2	7,5	0,771
Motor deficit	68	27,5	72	27,2	140	52,8	0
Encephalopathy	42	15,8	74	27,9	116	43,8	0,000
Arrhythmia Resp.	0	3	63	23,8	71	26,8	0
Pupillary reflex	0	1,5	47	17,7	51	19,2	0
Stem reflex	0	1,1	42	15,8	45	17	0,000
HIC	0	1,5	39	14,7	43	16,2	0
Cerebral edema	16	6	69	26	85	32,1	0,000
ECG[b]	13±3		8±4		11±4		0
Neurological complications							
Ischemic stroke	3	13	16	6,0	52	19,6	0,301
Hemorrhagic stroke	12	4,2	11	4,5	2	8,7	0,260
Metabolic encephalopathy	39	14,7	57	21,5	96	36,2	0
Seizure status	0	3,4	06	2,3	15	5,7	0,803
NeuroQx	60	22,6	02	8,0	62	23,3	0
Other complications	0	3	08	3	17	6	0,588
Extraneurological complications and life support							
APACHE II[bc]	13±6		24±8				0,000
Electrolyte imbalance	14	5,3	09	3,4	2	8,7	0,823
Hyperglycemia	21	7,9	60	22,6	81	30,6	0,000
Hypoxemia	07	2,6	51	19	58	21,9	0,000
VMA	47	17,7	93	35,1	140	52,8	0
Length of stay with AMI (days)[b]	1,5±3,3		5,4±6,5				0
UCIO stay (days)[b]	3,8±3,3		5,6±6,5				0

[a] calculated based on the total. [b] mean±SD (standard deviation) [c] ACOR: 0,84; 95 % CI: 0,799–0,894; p= 0,000.

Seven BLR models were tested with the variables that were significant in the univariate analysis. The variable "primary tumor location" was not taken into account because the analysis performed by the authors assumed that the proportion was associated with survival. The APACHE II score, stay in AMI, and stay in the ICU were also not included in the models as predictive variables. After performing the RLB analysis, six final models were obtained, as models 5 and 6 had the same results. The calculated models had good calibration (Hosmer-Lemeshow; p-value > 0,05) and excellent discriminatory power (AROC > 0,90). The AIC and BIC analysis showed better mathematical simplicity for model 7, as did the other considerations made (table 3).

The final adjusted mortality model for patients with solid tumors and severe neurological complications consisted of the following variables: ECOG III (OR: 3,62; 95 % CI: 1,05 - 12,46; p= 0,041), absence of pupillary reflex (OR: 9,35; 95 % CI: 2,24–38,99; p=0,002), HIC (OR: 17,91; 95 % CI: 3,02–105,91; p=0,001), hyperglycemia (OR: 5,85; 95 % CI: 2,07–16,49; p=0,001), hypoxemia (OR: 19,09; CI 95 %: 2,91–61,67; p=0,000) and VMA (OR: 9,59; CI 95 %: 2,59–35,51; p=0,001).

The results of the R^2 indicated good model performance, while the goodness-of-fit test with 6 degrees of freedom obtained a p-value >0,05, which validates the model by indicating that there are no statistically significant differences between the observed and expected values (table 4). The AUC showed excellent discrimination superior to APACHE II (figure 2).

Table 3. Binary logistic regression analysis to determine the final predictive models, performance, discrimination, and mathematical simplicity criteria

Model	Initial model variables	Final model variables	ACOR (95 % CI: p value)[a]	X^2 - Hosmer-Lemeshow	AIC - BIC[b]
1	ECOG III, Coma, Pupillary Reflex, Cerebral Edema, ICH, Hyperglycemia, Metabolic encephalopathy, Hypoxemia, AVA	ECOG III, Cerebral Edema, HIC, Hyperglycemia Metabolic Encephalopathy, Hypoxemia, VMA	0,984 (0,973 - 0,995; p= 0,000)	2,710; 0,844	58,52 - 87,16
2	QTP/RTP, Respiratory arrhythmia, Pupillary reflex, Coma, HIC, Metabolic encephalopathy, Hyperglycemia, Hypoxemia, VMA	Respiratory arrhythmia, Coma, HIC, Metabolic encephalopathy, Hyperglycemia, Hypoxemia, VMA	0,974 (0,959 - 0,990; p= 0,000)	6,753; 0,455	65,05- 90,07
3	ECOG III, QTP/RTP, Severe motor deficit, Pupillary reflex, Brain stem reflex, UUO, Hyperglycemia, Hypoxemia, VMA	Pupillary reflex, Brain stem reflex, UUO, Hyperglycemia, Hypoxemia, VMA	0,974 (0,958 – 0,991; p= 0,000)	4,394; 0,494	63,67 - 88,73
4	ECOG III, QTP/RTP, Metabolic encephalopathy, Severe motor deficit, Respiratory arrhythmia, Brain stem reflex, HIC, Hyperglycemia, Hypoxemia	ECOG III, Metabolic encephalopathy, Respiratory arrhythmia, HIC, Hyperglycemia, Hypoxemia	0,979 (0,966 – 0,993; p= 0,000)	1,123; 0,952	61,01 – 86,07
5	ECOG III, Coma, Severe motor deficit, Respiratory arrhythmia, Brain stem reflex, HIC, Hyperglycemia, Hypoxemia, VMA	ECOG III, Respiratory arrhythmia, HIC, Hyperglycemia, Hypoxemia, VMA	0,973 (0,955 – 0,992; p= 0,000)	2,986; 0,811	59,85- 84,91
6	ECOG III, Comorbidity, Pupillary Reflex, Respiratory Arrhythmia, Coma, HIC, Hyperglycemia, Hypoxemia, VMA				
7	ECOG III, Metastasis, Coma, Pupillary Reflex, Brain Stem Reflex, HIC, Hyperglycemia, Hypoxemia, VMA	ECOG III, Pupillary Reflex, HIC, Hyperglycemia, Hypoxemia, VMA	0,962 (0,936 – 0,988; p= 0,000)	4,774;0,444	51,28 - 76,34

[a] values from the final model. [b] values from the final model. CI: confidence interval. AUC: area under the ROC curve. AIC: Akaike information criterion. BIC: Bayesian information criterion. ECOG: *Eastern Cooperative Oncology Group*. ICH: intracranial hypertension. IMV: invasive mechanical ventilation. OEU: oncology emergency unit

Table 4. Binary logistic regression analysis of the final model selected for mortality

Variables	B	Standard error	p value	OR	95 % CI for OR	
					Lower	Upper
ECOG III	1,288	0,630	0,041	3,62	1,05	12,46
Pupillary reflex	2,236	0,729	0,002	9,35	2,24	38,99
HIC	2,885	0,907	0,001	17,91	3,02	105,91
Hyperglycemia	1,767	0,529	0,001	5,85	2,07	16,49
Hypoxemia	2,949	0,598	0,000	19,09	5,91	61,67
VMA	2,261	0,668	0,001	9,59	2,59	35,51
Constant	-4,495	0,638	0,000	0		

R^2 Snell: 0,58. R^2 Nagelkerke: 0,80. Hosmer–Lemeshow C test (x^2) = 4,77; p = 0,444). ACOR: 0,96 (95 % CI: 0,93–0,98; p= 0,000)

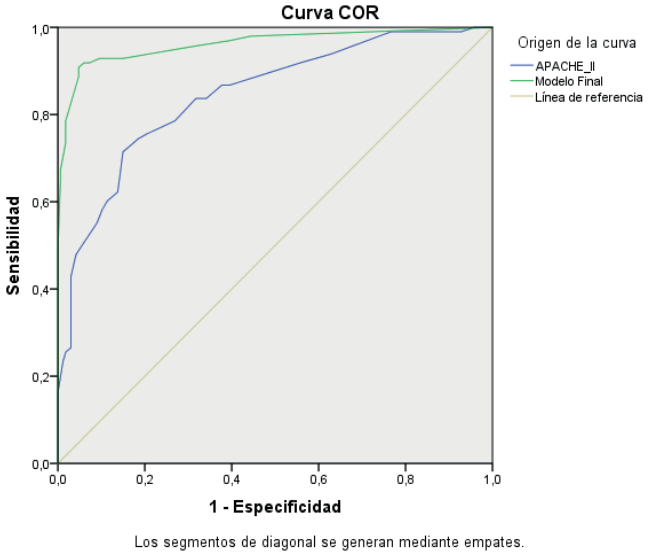

Figure 2. COR curve for the final model and APACHE II

The mortality prediction scale for patients with solid tumors and severe neurological complications was designed in this way. It had four components: 1_Clinical variable, 2_Neurological variables, 3_Laboratory variables, and 4_MAV. The score ranged from 0 to 13, with patients with scores between 0 and 2 presenting a low risk (probability ≤ 12 %), between 3 and 6 a moderate risk (probability up to 88,4 %), and ≥ 7 a high risk of death (probability ≥ 97 %). The scale classified 98,6 % of the study population who died as having a high risk of death (table 5).

Table 5. Proposed predictive mortality scale for patients with solid tumors and severe neurological complications

Variables	Calculation	Beta radio	Score	
			Present	Absent
ECOG III	1,28/1,28	1	1	0
Pupillary reflex	2,23/1,28	2,34	2	0
HIC	2,88/1,28	2	3	0
Hyperglycemia	1,76/1,28	1,66	2	0
Hypoxemia	2,94/1,28	2,50	3	0
MVA	2,26/1,28	1,88	2	0
Predictive Scale				
Category	Score	Probability	Patients	Mortality[ab]
Low risk	0	≤ 12	15	6 (3,8 %)
Moderate Risk	3	12 - 88,4	4	24
High Risk	7-13	≥ 88,4 - 99,9 %	69	68 (98,6 %)

[a]calculated based on patients. [b]p= 0,000

DISCUSSION

A prognostic scale for death was designed with adequate predictive capacity for patients with solid tumors and severe neurological complications. Its ease of use through the selected variables allows for rapid and extensive use in emergency units, operating rooms, or in prehospital assessment, in addition to the ICU. The prognosis of neurocritical patients remains a challenge, especially with regard to life support decisions, due to the perception of a poor neurofunctional prognosis. In the context of patients with malignancy, prognosis carries considerable uncertainty, raises ethical challenges, and can be complicated by clinical nihilism and self-fulfilling prophecy.[5,13] The functional status of critically ill patients prior to ICU admission may be an important prognostic factor, regardless of the severity of their physiological disturbance upon admission to the ICU.[14] Previous studies of critically ill onconeurological patients showed an association with mortality as ECOG increased.[15,16]

Based on these results, a consensus of European experts suggested that cancer patients in poor general condition (ECOG III or IV) within 1 month prior to ICU admission are unlikely to benefit from ICU admission. (*Grade C, strong recommendation)*.[17] Pupillary reflex assessment is a routine examination in the ICU for patients with neurological dysfunction. The integrity of the reflex arc through the brainstem is essential for the

pupillary reflex, making it a valuable tool for assessing brainstem function and a good predictor after acquired brain injury. Most studies in which this predictor has been validated are in traumatic brain injury (TBI). Some patients with initially poor neurological outcomes improve rapidly with a return of the pupil after normalization of hemodynamic values. Absent pupillary responses in a medium-sized pupil remain particularly indicative of an anoxic-ischemic injury that damages the brainstem, with or without ICH. Anisocoria, often irrelevant after light stimulation, may be an important biomarker of poor prognosis in neurocritical patients.[18,19,20,21]

The devastating effects of ICP on the CNS and the poor prognosis with mortality have been described. Intracranial pressure (ICP), as a simple numerical value, is not an independent predictor of outcome; that is, when used for prognosis, ICP data should be interpreted with caution to predict the effect in conjunction with clinical and demographic characteristics, CT findings, and other physiological data. Recent studies suggest that individualized or patient-specific targets may provide a stronger relationship with prognosis and treatment response.[22] Neumann et al.[23] found that 22,9 % of their study population had statistically significant HIC with mortality, as did Decavèle et al.[24] The hyperglycemic stress response is part of the adaptive metabolic response to critical illness, especially hypoxia, hemorrhage, and sepsis. In such circumstances, blood glucose levels increase as a result of insulin resistance caused by metabolic stress. This is associated with increased morbidity and mortality. There is little literature on the correlation between hyperglycemia, cancer, and mortality, and the lack of clarity in understanding these comorbid conditions contributes to higher mortality rates. This justifies a critical analysis of the factors responsible for the increase in mortality due to the coexistence of hyperglycemia and cancer.[25,26,27] Two recent meta-analyses highlight the importance of hyperglycemia in the acute phase of neurological complications as a predictor of short-term mortality. With primary reference to patients with ischemic stroke and TBI.[28,29,30,31] Hypoxemia represents the main source of secondary brain damage. In the acute stage of the critical event, brain tissue is particularly susceptible when O_2 levels fall below metabolically effective thresholds. Not only will this reduce cerebralO_2 supply, but it will also cause reflex vasodilation with a consequent increase in ICP. It has been reported that in the first hour of the event, SaO_2 < 90 % doubles the risk of death.[32] Authors consulted found in their neurocritical series that the presence of hypoxemia was a predictor of mortality.[33,34,35,36,37]

After brain injury, impaired consciousness and brainstem reflexes induce hypoventilation and precipitate bronchoaspiration. The first objective of AMV is therefore to protect the airway with endotracheal intubation. The use of AMI in neurocritical populations has been associated with poor prognosis. From a pathophysiological y point of view, it has been classically described that the damaged brain is sensitive to the pressometric, volumetric, and blood gas changes induced by AMI, and complications such as ICH and death have been reported. In severely neurologically impaired patients, the survival rate of those who require AMV is around 50 % at 30 days after the event, and only 30 % survive one year.[38,39,40] Despite this prognosis, AMV is a pillar of survival in critically ill and oncological patients. To date, references on AMI in neuro-oncology patients are scarce and, as in non-oncology patients, the prognosis is poor. Therefore, the therapeutic strategy is based on pathophysiological and clinical extrapolations from neurocritical patients in general.[16,23,24,41]

Strengths and limitations of the study

During the literature review on the subject, no similar studies were found that designed or validated a predictive scale of death for patients with cancer and neurological complications. Therefore, it is assumed that this study is of particular interest for this specific population and is the first of its kind in Cuba. From a practical standpoint, its use establishes the appropriate analysis of the patient, based on the benefits of a therapeutic strategy to reduce risk factors for death and its relationship to the prognosis of cancer. On the other hand, it can be integrated into automated systems (mobile applications) that are more accessible to the treating physician. Finally, since the variables that make up the scale were not found to be specific to cancer patients, it could be validated in the future in the population without this condition. Prognostic models for making predictions in individual patients are more accurate and are often preferred to so-called risk groups, as they allow for risk stratification. The clinical use of these models usually depends on evidence of adequate validation and, above all, on their usefulness when applied in clinical practice. [37] Among the limitations, the single-center nature of the study is noted. Furthermore, only internal validation of the model was performed, which determines the need for external validation to establish its usefulness more accurately.

CONCLUSIONS

A predictive scale of death was designed for patients with solid tumors and severe neurological complications using simple and easy-to-perform clinical elements. This allows for better clinical judgment of the prognosis of this poorly studied patient subpopulation.

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CONSENT

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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