Comparison of Mortality in Patients with Cancer Undergoing Invasive and Non-Invasive Ventilation: Retrospective Cohort Study

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Comparação da Mortalidade entre Pacientes com Neoplasias Submetidos à Ventilação Invasiva e não Invasiva: Estudo de Coorte Retrospectiva

Comparación de la Mortalidad entre Pacientes con Cáncer Sometidos a Ventilación Invasiva y no Invasiva: Estudio de Cohorte Retrospectivo

Diego Santos de Oliveira[1]; Renata Carneiro Firmo[2]; José Roberto da Silva Júnior[3]

ABSTRACT

Introduction: Cancer patients have a high prevalence of acute respiratory failure (ARF) related to complications of cancer treatment. Mechanical ventilatory support is the main therapy to resolve this complication. However, this procedure/intervention can increase mortality. **Objective:** To investigate the mortality rate and intervening factors of cancer patients with ARF exposed to invasive (IMV) and non-invasive mechanical ventilation (NIV). **Method:** Retrospective cohort study. 121 cancer patients on mechanical ventilation were enrolled divided into groups: IMV in patients with hematological neoplasms (IMVHN, n=17), NIV in hematological neoplasms (NIVHN, n=36), IMV in solid neoplasms (IMVSN, n=39) and NIV in solid neoplasms (NIVSN, n=29). The outcomes evaluated were: mortality rate, length of hospital stay, time of exposure to mechanical ventilation, NIV failure rate and factors related to NIV failure. **Results:** The overall mortality rate was 47.9%, distributed in IMVHN (82.4%), NIVHN (27.8%), IMVSN (69.2%) and NIVSN (24.1%). A high APACHE III score was associated with a higher mortality rate. The mortality rate associated with NIV failure was 71.4% IMVHN and 77.8% NIVSN. The variables associated with the highest NIV failure rate were APACHE III>17 and NIV exposure time>72 hours. **Conclusion:** The mortality rate of patients with hematologic and solid neoplasm in ARF was lower in patients exposed to NIV.

Key words: neoplasms/mortality; respiratory insufficiency; respiration, artificial; noninvasive ventilation.

RESUMO

Introdução: O paciente com câncer apresenta alta prevalência de insuficiência respiratória aguda (IRpA) relacionada a complicações do tratamento oncológico. O suporte ventilatório mecânico é a principal terapêutica para resolução dessas complicações. No entanto, tal recurso pode aumentar a mortalidade. **Objetivo:** Verificar a taxa de mortalidade e os fatores intervenientes de pacientes oncológicos com IRpA expostos à ventilação mecânica invasiva (VMI) e não invasiva (VNI). **Método:** Estudo de coorte retrospectiva. Foram incluídos 121 pacientes oncológicos em ventilação mecânica separados em grupos: neoplasias hematológicas em VMI (HVMI, n=17), neoplasias hematológicas em VNI (HVNI, n=36), neoplasias sólidas em VMI (SVMI, n=39) e neoplasias sólidas em VNI (SVNI, n=29). Os desfechos avaliados foram: taxa de mortalidade, tempo de internamento, tempo de exposição à ventilação mecânica, taxa de falha da VNI e fatores relacionados à falha da VNI. **Resultados:** A taxa de mortalidade geral foi de 47,9%, distribuídos em HVMI (82,4%), HVNI (27,8%), SVMI (69,2%) e SVNI (24,1%). O escore APACHE III elevado foi associado a uma maior taxa de mortalidade. A taxa de mortalidade associada à falha da VNI foi de 71,4% HVNI e 77,8% SVNI. As variáveis associadas à maior taxa de falha da VNI foram o APACHE III>7 e o tempo de exposição à VNI>72 horas. **Conclusão:** A taxa de mortalidade de pacientes com neoplasia hematológica e sólida em IRpA mostrou-se menor em pacientes expostos à VNI.

Palavras-chave: neoplasias/mortalidade; insuficiência respiratória; respiração artificial; ventilação não invasiva.

RESUMEN

Introducción: Los pacientes con cáncer tienen una alta prevalencia de insuficiencia respiratoria aguda (IRA) relacionada con las complicaciones del tratamiento del cáncer. El soporte ventilatorio mecánico es la principal terapia para resolver esta complicación. Sin embargo, esta característica puede aumentar la mortalidad. **Objetivo:** Verificar la tasa de mortalidad y factores intervinientes de pacientes oncológicos con IRA expuestos a ventilación mecánica invasiva (VMI) y no invasiva (VNI). **Método:** Estudio de cohorte retrospectiva. Se incluyeron 121 pacientes oncológicos en ventilación mecánica, divididos en grupos: neoplasias hematológicas en VMI (HVMI, n=17), neoplasias hematológicas en VNI (HVNI, n=36), neoplasias sólidas en VMI (SVMI, n=39) y neoplasias sólidas en VNI (SVNI, n=29). Los resultados evaluados fueron: tasa de mortalidad, duración de la estadía, tiempo de exposición a la ventilación mecánica, tasa de falla de la VNI y factores relacionados con la falla de la VNI. Los resultados se presentaron como media y desviación estándar, mediana y rango intercuartílico o proporciones. Se consideraron valores de p<0,05. **Resultados:** La tasa de mortalidad global fue del 47,9%, distribuida en HVMI (82,4%), HVNI (27,8%), SVMI (69,2%) y SVNI (24,1%). Una puntuación alta de APACHE III se asoció con una mayor tasa de mortalidad. La tasa de mortalidad asociada con el fracaso de la VNI fue del 71,4% de la VNI y del 77,8% de la VNI. Las variables asociadas con la mayor tasa de fracaso de VNI fueron APACHE III>17 y tiempo de exposición a VNI>72 horas. **Conclusión:** La tasa de mortalidad de los pacientes con neoplasia hematológica y sólida en IRpA fue menor en los pacientes expuestos a VNI.

Palabras clave: neoplasias/mortalidad; insuficiencia respiratoria; respiración artificial; ventilación no invasiva.

[1]Instituto de Medicina Professor Fernando Figueira (IMIP). Recife (PE), Brazil. E-mail: oliveirads@hotmail.com.br. Orcid iD: https://orcid.org/0000-0002-1355-2870
[2,3]IMIP. Faculdade Pernambucana de Saúde (FPS). Recife (PE), Brazil. E-mails: renatacarneirof@hotmail.com; jr.roberto.jr@gmail.com. Orcid iD: https://orcid.org/0000-0002-6196-6322; Orcid iD: https://orcid.org/0000-0003-3843-005X
Corresponding author: Diego Santos de Oliveira. Rua Doutor João Marques, 60, Edifício Bosque Ilha do Retiro, apartamento 104 – Ilha do Retiro. Recife (PE), Brazil. CEP 50750-320. E-mail: oliveirads@hotmail.com.br

INTRODUCTION

Patients hospitalized at the Intensive Care Unit (ICU) with hematological and solid neoplasms are at high risk of death associated with multiple organ failure[1,2]. The most prevalent organ failure is acute respiratory failure (ARF), accounting for 40% of the causes of admission to ICU[3,4]. The most common causes of ARF of this population are pneumonia, extra-pulmonary infection, drug-induced pneumonitis, alveolar hemorrhage and progression of the disease[5-7].

Invasive mechanical ventilation (IMV) and non-invasive ventilation (NIV) are the main supportive therapies for patients with ARF[5]. The necessity of intubation and the consequential IMV is described as one of the main factors associated with mortality of patients with neoplasms, mainly hematological[5,8-10].

The utilization of NIV, given the acknowledged reduction of mortality of patients with hematological neoplasms, is still controversial because of the heterogeneity of the studies[11-13]. The early utilization of NIV appears to improve the patient's status, possibly reducing the necessity of admission to ICU for endotracheal intubation and the rate of mortality of patients with neoplasm[11,12]. However, the indication to NIV for patients with high risk of failure can postpone the intubation and consequently increase the rate of mortality[13]. The NIV-related risk factors are commonly mentioned as severity of the acute respiratory distress syndrome (ARDS) and high scores of mortality[12,13].

Therefore, evidences are still unclear despite the repercussions of IMV and NIV over the outcome mortality of oncologic patients. The objective of the present study was to evaluate and compare the clinical characteristics, mortality rate and intervening factors of patients with hematological and solid neoplasms submitted to IMV and NIV as first therapeutic choice to treat ARF.

METHOD

Retrospective cohort study conducted at the clinic ICU of "*Instituto de Medicina Integral Professor Fernando Figueira (IMIP)*" in Recife (PE) through analysis of database from November 2016 to November 2018 approved by the Institutional Review Board of IMIP, CAAE (Submission for ethical review) 11275019.2.0000.5401.

A specific standard form developed for the study was applied to collect the data. The team was trained to minimize errors. Charts of individual with or older than 18 years of age with diagnosis of solid or hematological neoplasm admitted at the ICU due to ARF ($pO_2 \leq 60$ mmHg and/or $pCO_2 \geq 45$ mmHg)[5] and who needed IMV and non-invasive ventilation during hospitalization were enrolled. Incomplete charts, intubated patients with lower consciousness unrelated to ARF, with pulmonary disease associated with chronic obstructive pulmonary disease (COPD) and ARDS, in post cardiorespiratory arrest, with diagnosis of pulmonary and upper airway neoplasm and/or pulmonary metastasis were excluded.

Patients with hematological and solid neoplasms admitted at ICU due to ARF were exposed to IMV or NIV as first choice therapy for acute cases. The choice of support was contingent upon a regular consultation with the physician and the attending physiotherapist. The criteria for IMV was refractory hypoxemia, necessity of prolonged ventilatory support and control of pulmonary ventilation (hydrogenionic potential – pH<7.25)[14]. NIV was performed to prevent IMV in patients with mild to moderate acute respiratory acidosis (pH 7.25-7.35 and $PaCO_2$>45mmHg)[15]. Intermittent NIV sessions occurred from one to two hours and at least, three times a day according to the routine.

NIV failure was defined as the necessity of intubation after exposure to NIV as first strategic therapeutic for ARF. Failure criteria were: asynchrony patient-ventilator, non-improvement of the variables heart rate and respiratory frequency, arterial blood pH, oxygen partial pressure (pO_2) and arterial carbon dioxide (pCO_2) and Glasgow coma scale evaluated from one to two hours of exposure to NIV[15,16].

Upon charts review, patients were divided in four groups considering the first ventilation support they were exposed to: group of hematological neoplasms exposed to IMV (HIMV), group of hematological neoplasms exposed to NIV (HNIV), group of solid neoplasms exposed to IMV (SIMV) and group of solid neoplasms exposed to NIV (SNIV). Patients who failed NIV and had to be submitted to IMV were excluded from the group exposed to IMV.

Different individuals typed the data extracted from charts. After the double typing process, the databases were compared, and errors and inconsistencies were corrected. A single, definitive and unique database was created, submitted to cleaning tests and data consistency and utilized for statistical analyzes with additional safety copies.

Anthropometric (sex, weight and age), clinical (type of respiratory failure and risk of death) and oncological (treatment, relapse and metastasis) characteristics were obtained at admission at ICU. The score Acute Physiologic and Chronic Health Evaluation III (APACHE III)[17] was evaluated at ICU admission. The day the exposure to mechanical ventilation began was day zero, the first ventilatory support chosen (IMV or NIV), duration of

mechanical ventilation, ICU length of stay and rate of mortality were recorded. Clinical and oncological variables were utilized to evaluate the NIV-failure associated factors.

The primary outcome was the mortality rate at ICU. Secondary outcomes were intervening factors as anthropometric, clinical and oncological characteristics, length of stay at ICU, time of exposure to IMV and to NIV, rate of failure of NIV and factors associated with NIV failure.

Results were expressed as mean and standard-deviation, mean and interquartile range or proportions, as required. Chi-square test was utilized to compare the proportions or the Fisher exact test when the conditions to apply the chi-square test were not met. The Student's *t* test was applied to compare the means and the medians with robust methods.

The null hypothesis (proportion of success NIV = 50%) and alternative hypothesis (proportion of success ≠ 50%) were considered to analyze the NIV-related failure factors. The probability estimates were calculated by the Kaplan-Meier test to evaluate the proportion of patients-free of NIV failure in function of time as analysis of survival. The analysis of the correlation of APACHE III as probability of failure was performed with Pearson's correlation coefficient.

Values of $p<0.05$ were statistically significant, all the analyzes utilized the software Stata, version 12.1 SE (StataCorp LP, College Station, Texas, EUA).

RESULTS

For the study period, 296 patients were admitted to the ICU, 134 met the eligibility criteria, nevertheless, 13 were excluded due to incomplete data, and eventually 121 (90%) patients formed the population of the study. The main cause of exclusion of patients with neoplasms and ARF was not accepting mechanical ventilation, utilizing only high or low oxygen supportive therapy. Figure 1 portrays the distribution by groups of HIMV (n=17), HNIV (n=36), SIMV (n=39) and SNIV (n=29); 23 patients who failed NIV were separated in one group.

Table 1 shows anthropometric, clinical, oncological characteristics and mortality of patients. No differences of the variables age, weight and sex were found. Hypoxemic ARF predominated for the hematological and solid neoplasms groups exposed to NIV when compared with the group exposed to IMV. Mortality score APACHE III was higher for the exposed to IMV compared to exposed to NIV, regardless of the type of neoplasm. More frequency of patients without treatment in the group of HNIV (50%) and of chemotherapy treatment in the group of SNIV (79.5%) was found.

The rate of general mortality was 47.9%, the mortality rate of IMV-exposed was 73.2%, and 26.1% for NIV-exposed according to Table 1; the mortality rate of patients who failed NIV was 73.9% (n=17). According to Table 2, the mortality rate was 82.3% for HIMV, 27.8% for HNIV, 69.2% for SIMV and 24.1% for SNIV.

The median of the score APACHE III was HIMV 33 (31-36), HNIV 17.5 (12.5-24.2), SIMV 27 (19-38) and SNIV 19 (13-21). The rate of mortality was low for the groups exposed to NIV. Length of stays in days at ICU did not differ among the groups. There was less time of utilization of ventilatory support for the group SNIV than the group SIMV. No difference of the rate of mortality, length of hospital stay and days of ventilatory support for HIMV *versus* SIMV and HNIV *versus* SNIV was found (Table 2).

The rate of NIV failure of all exposed was 35.3% (Table 1). No significant difference of the NIV-failure was found in timing to failure and rate of deaths associated with NIV when compared to hematological neoplasms (38.9%) *versus* solid neoplasms (31.0%). However, it was found an elevated rate of mortality of patients who failed NIV, with a rate of 71.4% of the group HNIV and 77.8% of the group SNIV (Table 3).

NIV failure occurred more frequently in patients with elevated APACHE III mortality score [NIV success (15.5±0.9) *versus* NIV-failure (23.8±2.4); p=0.003)], the other variables were not statistically significant (Table 3). There was strong correlation among NIV-failure with elevated APACHE III score (Pearson's r=0.96). The patients with APACHE III score >17 had odds above 30% of NIV-failure (Graph 1).

Prolonged time of exposure to NIV in intermittent sessions was also a variable related to NIV-failure. Patients exposed to NIV had low rate of failures in the first 24, 48 and 72 hours of exposure of 16.9%, 24% and 32.4%, respectively. After 72 hours, a plateau of NIV-failure of 38.1% was reached, covering the period from the third to the eighth day of intermittent exposure to NIV. In the subsequent days, the failure rate was equal or higher than 50% (Graph 1).

DISCUSSION

Patients exposed to NIV had lower mortality rate when compared to those exposed to IMV, associated with the severity measured by the prognostic index APACHE III, regardless of the group. NIV failure occurred in 35.2% of all the intermittent NIV-exposed with high score APACHE III and timing of exposure to NIV are related to NIV failure, possibly associated with increase of mortality rate of NIV-exposed.

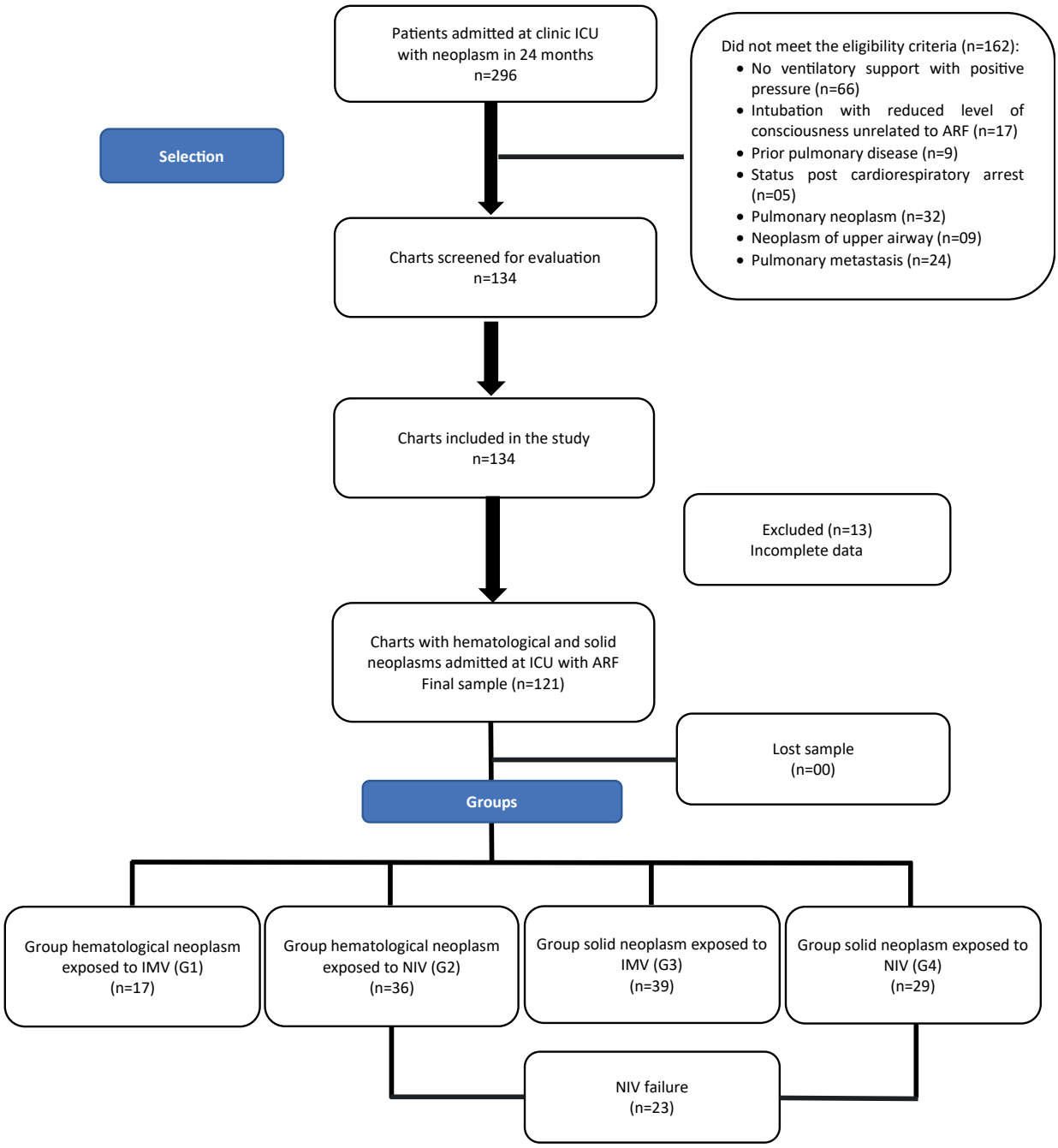


Figure 1. Flowchart of patients enrollment

The mortality rate of the entire sample was 47.9%, lower than the rate of 64%[8] described in the literature. For patients with solid and hematological neoplasms and needing IMV, the mortality rate was higher when compared with patients in NIV alone. The drop of mortality rate of the sample can be associated with low severity of the patients at admission, reducing the score of mortality and risk of therapeutic failure[17-21].

The APACHE III high mortality score was the main variable related to the elevated mortality rate for all the groups investigated, showing that as high the APACHE III mortality score is, higher is the risk of death, corroborating the literature[8,10,19-23].

Patients with solid neoplasms exposed to NIV in the sample presented a mortality rate of 24.1% lower than the results presented by Chen et al.[22], who showed mortality rate of 39.6% of the patients with pulmonary neoplasm. Possibly, the reduction of the mortality rate is related to the exclusion of patients with pulmonary neoplasms or metastasis or at the airways because of the possibility of

Table 1. Anthropometric, clinical, oncological characteristics and mortality of the study patients with neoplasms, IMIP, 2019

Variables	HIMV (n=17)	HNIV (n=36)	Value of p†	SIMV (n=39)	SNIV (n=29)	Value of p†
Anthropometric characteristics						
Age (years), mean (SD)	55.9 (±17.7)	51.5 (±18.3)	0.413*	58.1 (±15.1)	60.1 (±16.9)	0.609*
Weight (kg), mean (SD)	61.2 (±10.4)	66.9 (±12.9)	0.118*	66.2 (±11.3)	62.8 (±13.3)	0.259*
Males, n (%)	10 (58.8)	19 (52.8)	0.680^{P}	17 (43.6)	12 (41.4)	0.855^{P}
Clinical characteristics						
Hypoxemic, ARF n (%)	7 (41.2)	30 (83.3)	**0.002**^{P}	14 (35.9)	21 (72.4)	**0.003**^{P}
Hypercapnic ARF, n (%)	6 (35.3)	5 (13.9)	0.143^{F}	18 (46.2)	7 (24.1)	0.078^{F}
Mixed ARF, n (%)	4 (23.5)	1 (2.8)	0.052^{F}	7 (17.9)	1 (3.4)	0.125^{F}
APACHE III mortality score, median (IQR) (n)	33 (31-36)	17.5 (12.7-24.2)	**<0.001****	27 (19-38)	19 (13-21)	**<0.001****
Oncological characteristics						
Neoplasm relapse, n (%)	2 (11.8)	1 (2.8)	0.238^{F}	9 (23.1)	8 (27.6)	0.671^{P}
Metastasis, n (%)	2 (11.8)	0 (0.0)	0.099^{F}	9 (23.1)	6 (20.7)	1.000^{P}
Without treatment, n (%)	3 (17.6)	18 (50.0)	**0.035**^{F}	6 (15.4)	7 (24.1)	0.364^{P}
Chemotherapy treatment, n (%)	11 (64.7)	10 (27.8)	**0.016**^{P}	31 (79.5)	16 (55.2)	0.038^{P}
Radiotherapy treatment, n (%)	1 (5.9)	0 (0.0)	0.321^{F}	0 (0.0)	2 (6.9)	0.178^{F}
Surgical treatment, n (%)	0 (0.0)	3 (8.3)	0.543^{F}	0 (0.0)	1 (3.4)	0.426^{F}
Combined treatment, n (%)	2 (11.8)	5 (13.9)	1.000^{F}	2 (5.3)	3 (10.3)	0.644^{F}
Mortality						
General mortality rate, n (%)		58/121 (47.9%)				
General mortality rate of exposed to IMV, n (%)		41/56 (73.2%)				
General mortality rate of exposed to NIV, n (%)		17/65 (26.1%)				
Rate of general failure of NIV, n (%)		23/65 (35.3%)				
General mortality rate of NIV failure, n (%)		17/23 (73.9%)				

Captions: HIMV = group of hematological neoplasms with invasive mechanical ventilation; HNIV = group of hematological neoplasms with non-invasive ventilation; SIMV = group of solid neoplasms with invasive mechanical ventilation; SNIV = group of solid neoplasms with non-invasive ventilation; ARF = acute respiratory failure; APACHE III = score Acute Physiologic and Chronic Health Evaluation III; IMV = invasive mechanical ventilation; NIV = non-invasive ventilation; kg = kilogram; F = Fisher exact test; p = Pearson chi-square X2 test; SD= standard-deviation; IQR = interquartile range.
(*) Student t test.
(**) Wilcoxon-Mann-Whitney test.
(†) Values marked with letter p.

Table 2. Intragroup and intergroup IMV versus NIV and hematological neoplasm versus solid neoplasm, IMIP, 2019

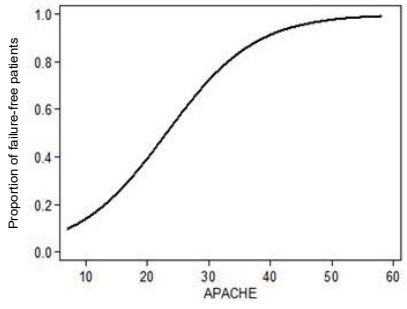
	HIMV n=17	HNIV n=36	p	SMIV n=39	SNIV n=29	p
Mortality rate, n (%)	14 (82.3)	10 (27.8)	<0.001*	27 (69.2)	7 (24.1)	**<0.001***
ICU length of stay in days, median (IQR)	4 (2-10)	5 (3-9)	0.54†	7 (3-12)	6 (4-9)	0.45†
Days of mechanical ventilation, median (IQR)	3 (1-8)	3 (1-5)	0.28†	5 (2-12)	3 (2-4)	**0.010†**
	HIMV n=17	**SIMV n=39**	**p**	**HNIV n=36**	**SNIV n=29**	**p**
Mortality rate, n (%)	14 (82.3)	27 (69.2)	0.51*	10 (27.8)	7 (24.1)	0.78*
ICU length of stay in days, median (IQR)	4 (2-10)	7 (3-12)	0.42	5 (3-9)	6 (4-9)	0.50
Days of mechanical ventilation, median (IQR)	3 (1-8)	5 (2-12)	0.38	3 (1-5)	3 (2-4)	0.84

Captions: HIMV = group of hematological neoplasms with invasive mechanical ventilation; HNIV = group of hematological neoplasms with non-invasive ventilation; SIMV = group of solid neoplasms with invasive mechanical ventilation; SNIV = group of solid neoplasms with non-invasive ventilation; ICU = Intensive Care Unit; IQR = interquartile range.
(*) Fisher exact test.
(†) Wilcoxon rank sum test.

Table 3. Comparison of the NIV failure rate, timing to NIV failure, mortality rate associated with NIV failure and factors associated with NIV failure for solid hematological neoplasms of the study patients, IMIP, 2019

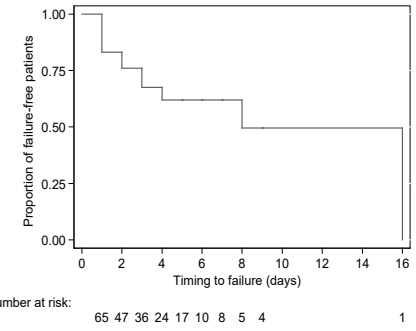
NIV failure	Hematological n=36 (%)	Solid n=29 (%)	p
Rate of NIV failure, n (%)	14/22 (38.9)	9/20 (31.0)	0.510*
Timing to NIV failure, mean (SD)	3.5 (3.4)	3.1 (2.0)	0.559**
Mortality rate associated with NIV failure, n/total (%)	10/14 (71.4)	7/9 (77.8)	1.000††
NIV failure associated factors	**Success NIV n=42 (%)**	**Failure NIV n=23 (%)**	**p**
Hematological neoplasm (n=36)	22/36 (61.1)	14/36 (38.9)	0.243
Solid neoplasm (n=29)	20/29 (69.0)	9/29 (31.0)	0.618
Mortality score (n=65)***	15.5±0.9	23.8±2.4	**0.003†**
Hypoxemic ARF	31/51 (60.8)	20/51 (39.2)	0.161
Hypercapnic ARF	9/12 (75.0)	3/12 (25.0)	0.146
Mixed ARF	2/2 (100.0)	0/2 (0.0)	0.500
Neoplasm relapse	7/9 (77.8)	2/9 (22.2)	0.180
Metastasis	2/6 (33.3)	4/6 (66.7)	0.687
Without treatment	15/25 (60.0)	10/25 (40.0)	0.424
Chemotherapy treatment	16 (61.5)	10 (38.5)	0.327
Radiotherapy treatment	1/2 (50.0)	1/2 (50.0)	1.000
Surgical resection	3/4 (75.0)	1/4 (25.0)	0.625
Combined treatment	7/8 (87.5)	1/8 (12.5)	0.070

Captions: ARF = acute respiratory failure; NIV = non-invasive ventilation; SD = standard-deviation.
(*) Pearson's chi-square test.
(**) Student t test with unequal variances (Welch's correction).
(***) Score in absolute values, the sessions represent the mean.
(†) Comparisons of the means of the variables score of mortality and risk of death by Student t test.
(††) Fisher exact test.



APACHE III	Probability of NIV-failure (%)
7	9.7
12	17.6
17	30.0
22	46.2
27	63.2
32	77.4
37	87.3
42	93.2
47	96.5
52	98.2
57	99.1

* Pearson's r = 0.96



Timing	Percentage of patients NIV-failure-free	CI 95%	
1	83.1	71.5	90.3
2	76.0	63.3	84.8
3	67.6	53.6	78.1
4	61.9	47.0	73.8
5	61.9	47.0	73.8
6	61.9	47.0	73.8
7	61.9	47.0	73.8
8	49.6	24.4	70.5
9	49.6	24.4	70.5
16	0		

Graph 1. Probability of NIV failure by APACHE III score and proportion of patients-free of NIV failure

Captions: NIV = non-invasive ventilation; APACHE III = score Acute Physiologic and Chronic Health Evaluation III.
(*) Pearson's correlation coefficient.

affecting the conduction of the air inhaled and overload of the ventilatory mechanic, reducing the efficacy of NIV in solid neoplasms of the respiratory system[22-28].

The patients who needed NIV had a failure rate of 38.9% in the group of HNIV, of 31.0% in the group of SNIV and 35.3% adding the two groups. Therefore, it was found a NIV failure lower than described by Gristina et al.[25], with a rate of 46% in patients with hematological neoplasms. Possibly, the lower rate of NIV failure of the sample can be associated with patients who needed NIV and were successful with APACHE III score lower than seven.

Analyzing the patients who failed at NIV, the mortality rate was similar to HNIV *versus* SNIV. However, 73.2% of all the patients who failed at NIV and consequently needed IMV, died. The present results suggest that the main factor associated with NIV failure was the severity of the patients at ICU admission measured by APACHE III and that NIV failure and subsequent IMV increased the mortality rate of NIV-exposed[16,24,29].

Lower APACHE III score than 17 may be attributed to 70% of odds of successful NIV in treating ARF in patients with extrapulmonary neoplasms. Other studies found that APACHE III score higher than 35 presented a mortality rate greater than 80% and also to great odds of NIV failure, increasing as high the score is[24-29].

Time of intermittent prolonged exposure to NIV may be associated with great odds of NIV failure. Patients with time of exposure to NIV lower than 72 hours had 32.4% less odds of NIV failure. A study evaluated that at bed, the predictive factors for NIV failure in clinical patients with acute respiratory distress syndrome (ARDS) and patients with lung cancer had an APACHE III score of 19±6, NIV failure rate of 47.9% and hospital mortality rate of 66% for patients intubated in until 12 hours of exposure to NIV and 79% for intubated after 12 hours of exposure to NIV[16]. However, the results of the present study presented lower NIV failure, even with approximate APACHE III scores, possibly because the sample did not include patients with ARDS and lung cancer, clinical conditions which presented alterations of respiratory mechanic[22-31].

The limitations of the study are that only one site was investigated and the sample was small, therefore, the extrapolation should be done wisely. Experimental studies as randomized clinical trials should be carried out to conclude whether there is causality correlation among exposure to IMV and NIV and mortality of patients with neoplasms and/or studies utilizing tools to evaluate the severity, morbidity, prediction of mortality and daily therapeutic response, for intance, the score of the prognostic index Sequential Organ Failure Assessment. However, clinical trials can face ethical obstacles related to the randomization and the choice of the type of mechanical ventilation.

CONCLUSION

The rate of mortality of patients with hematological and solid neoplasm with ARF was lower in patients submitted to NIV when compared to patients needing IMV. The APACHE III mortality score and time of exposure to NIV>72h are variables related to NIV-failure in oncological patients, which can be associated with increase of mortality of patients exposed to NIV.

CONTRIBUTIONS

All the authors contributed to the study design, acquisition, analysis and interpretation of the data, wording and critical review. They approved the final version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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Scientific-Editor: Anke Bergmann. Orcid iD: https://orcid.org/0000-0002-1972-8777