



SCIENTIFIC LETTER

Increase in the incidence of chronic critical disease in a University Hospital over eight years



Aumento de la incidencia de enfermedades críticas crónicas en un hospital universitario a lo largo de ocho años

Dear Editor,

With the evolution of advanced therapeutic approaches there has been an increase in the number of patients who survive the acute episode of critical illness but continue to present an organic dysfunction. Due to the difficulty in identifying the transition between acute and chronic critical illness, there is still controversy over the definition of a chronic critical patient. The presence of prolonged mechanical ventilation due to respiratory failure and the presence of tracheostomy are common findings in these patients and the current literature characterizes these as indicators of the definition.¹

Kahn et al. propose a more current definition developed by the *Research Triangle Institute*.² Chronic critical illnesses occur in 5–10% of patients admitted to the intensive care unit (ICU), and may reach a percentage of 12–20%, with an anticipated growth of 50–100% every decade.³ Less than 10% of patients diagnosed with chronic critical illness have functional independence after hospital discharge and less than 50% have a survival expectancy of one year.⁴ Among the survivors, 70% require permanent support such as home hospitalization or institutionalization.

Since there are few published epidemiological data, especially in Latin America, we describe the incidence, clinical characteristics, and independent risk factors of evolution to chronic critical illness in our institution.

In a retrospective longitudinal study carried out from January 2009 to December 2016 in a University Hospital, all adult patients admitted consecutively to the ICU were included. Patients with incomplete data in their medical records and re-admissions to the ICU were excluded.

The type of ICU admission was classified into three groups: clinical, elective surgery, and emergency surgery. Chronic critical illness definitions applied published criteria and considered one of the following conditions: mechanical

ventilation for at least 96 h, tracheostomy, stroke, head trauma, sepsis and severe wounds, associated with an ICU stay of eight days or more.² Sepsis was defined according to Sepsis-2 definitions at the time of study period.⁵ Criteria to identify patients who can be discharged from the ICU are protocolized, but the decision is made with the agreement of the responsible physician.

For the purpose of comparisons and analysis of risk factors for chronic critical illness, the sample collected was divided into two groups. The first group consisted of chronic critical patients and the second group of acute critical patients, i.e., those patients who present an improvement in the acute condition or die before meeting the chronic critical illness criteria. Regarding statistical analysis, for the dependent outcome (chronic critical illness) a bivariate model was used to evaluate the potential predictor variables. In addition, a multivariate logistic regression model using the *stepwise forward* method was applied to evaluate factors that contributed independently to explain the outcome, the effect of each factor was expressed as *odds ratio* (OR) and 95% confidence interval (95% CI). The significance level was 5% and the analyses were performed using MedCalc Statistical Software version 18.9 (MedCalc Software, Ostend, Belgium).

A total of 5044 patients were included in the study, of which 31.8% were Chronic Critical Patients and 68.2% Acute Critical Patients. Incidence of chronic critical patients varied from 26.1% to 39.8%. During the observation period, there was a trend towards an increase in the incidence of patients with Chronic Critical Illness over the years ($p < 0.001$).

Patients were admitted to the ICU from the operating room (61.3%), emergency room (25.7%), nursing ward (12.8%), and other hospitals (0.09%). In general, at admission of patients, the most frequent diagnoses were sepsis (29.2%), post-operative neurological complications (9.3%), and post-operative cardiovascular complications (6.3%). At ICU admission, 2654 (52.6%) patients received mechanical ventilation. In chronic critical patients the most frequent admission diagnoses were sepsis (47.4%) and cardiorespiratory arrest (5.6%).

The conditions most frequently encountered as a diagnostic criterion in chronic critical patients were mechanically ventilation for at least 96 hours (95.6%), sepsis (47.4%), and the presence of tracheostomy (45.0%).

Table 1 Univariate and multivariate analysis for factors independently associated with chronic critical illness.

Variable	Unadjusted OR	CI 95%	p-Value	Adjusted OR	CI 95%	p-Value
Age	1.0004	0.9967–1.0041	0.8321			
Sex	1.1845	1.0266–1.3667	0.0203	1.1857	1.0280–1.3676	0.0193
Single vasoactive drug	1.3879	1.1813–1.6308	0.0001	1.3784	1.1745–1.6177	0.0001
Multiple vasoactive drugs	0.7755	0.6293–0.9556	0.0170	0.7613	0.6199–0.9349	0.0093
Hemodialysis	0.8579	0.5562–1.3234	0.4883			
MV on admission	6.9216	5.7046–8.3982	<0.0001	6.9187	5.7086–8.3853	<0.0001
Chronic illness	0.8369	0.6845–1.0232	0.0825			
Clinical admission	1.6549	0.6663–4.1102	0.2778	1.4599	1.2479–1.7078	<0.0001
PoElective	0.4465	0.1782–1.1188	0.0853	0.4041	0.3256–0.5016	<0.0001
PoEmergency	1.1045	0.4440–2.7475	0.8307			

MV: mechanical ventilation; PoElective: post-operative elective surgery; PoEmergency: post-operative emergency surgery; OR: odds ratio; CI 95%: 95% confidence interval.

In the multivariate regression analysis of risk factors for chronic critical illness the following independent risk factors were found: male gender (OR: 1.18; 95% CI 1.02–1.36), vasoactive drug use (OR 1.37, 95% CI 1.17–1.61), mechanical ventilation at admission (OR 6.91, 95% CI 5.70–8.38), and clinical admission category (OR 1.45; 95% CI 1.24–1.70) (Table 1).

The incidence of Chronic Critical Illness in our institution can be considered elevated when compared to the literature. This condition occurs in between 5% and 10% of patients admitted to the ICU, ranging from 12% to 20% depending on the study.^{2,3,6} The higher incidence in the present study may be justified by the high incidence of sepsis (59.1%) at the study site⁷ when compared to the literature (30%),^{8,9} as this condition is considered for the classification of chronic critical illness. Furthermore, the high percentage of surgical patients and neurosurgery services also may have had a significant influence on the incidence of this type of patients.

There are few studies in the literature that show the risk factors for chronic critical illness. Loss et al. described the presence of sepsis at ICU admission, invasive ventilatory support, mental alterations, overweight, insufficient nutrition in the acute phase, and high prognostic scores in the SOFA and APACHE II.⁶ Carson et al. described the need for vasopressors, hemodialysis, a platelet count below 150,000, and the patient's age (50 years or more) as predictors of chronic critical illness.¹⁰

In conclusion, there was a high incidence of chronic critical illness in this study, besides a trend to increasing incidence over the years. The conditions predominantly found in the chronic critical patient were prolonged mechanical ventilation, the presence of tracheostomy, and sepsis. The risk factors for chronic critical illness were male gender, single vasoactive drug use, mechanical ventilation at admission, and clinical admission category.

Funding

No funding to declare.

Conflict of interest

No conflict of interest.

References

1. Marchioni A, Fantini R, Antenora F, Clini E, Fabbri L. Chronic critical illness: the price of survival. *Eur J Clin Invest.* 2015;45:1341–9.
2. Kahn JM, Le T, Angus DC, Cox CE, Hough CL, White DB, et al. The epidemiology of chronic critical illness in the United States. *Crit Care Med.* 2015;282–7.
3. Macintyre NR. Chronic critical illness: the growing challenge to health care. *Respir Care.* 2012;57:1021–7.
4. Mira JC, Gentile LF, Mathias BJ, Efron PA, Brakenridge SC, Mohr AM, et al. Sepsis pathophysiology, chronic critical illness, and persistent inflammation–immunosuppression and catabolism syndrome. *Crit Care Med.* 2017;45:253–62.
5. Levy MM, Fink MP, Marshall JC, Abraham E, Angus D, Cook D, et al. SCCM/ESICM/ACCP/ATS/SIS. 2001 SCCM/ESICM/ACCP/ATS/SIS international sepsis definitions conference. *Crit Care Med.* 2003;31:1250–6.
6. Loss SH, Marchese CB, Boniatti MM, Wawrzyniak IC, Oliveira RP, Nunes LN, et al. Prediction of chronic critical illness in a general intensive care unit. *Rev Assoc Med Bras.* 2013;59:241–7.
7. Kauss IAM, Grion CMC, Cardoso LTQ, Anami EHT, Nunes LB, Ferreira GL, et al. The epidemiology of sepsis in a Brazilian teaching hospital. *Braz J Infect Dis.* 2010;14:264–70.
8. Machado FR, Cavalcanti AB, Bozza FA, Ferreira EM, Carrara FSA, Sousa JL. The epidemiology of sepsis in Brazilian intensive care units (the Sepsis PRE valence Assessment Database, SPREAD): an observational study. *Lancet Infect Dis.* 2017.

9. Vincent JL, Lefrant JY, Kotfs K, Nanchal R, Loeches IM, Wittebole X, et al. Comparison of European ICU patients in 2012 (ICON) versus 2002 (SOAP). *Intensive Care Med.* 2018;44:337–44.
10. Carson SS, Garrett J, Hanson LC, Lanier J, Govert J, Brake MC, et al. A prognostic model for one-year mortality in patients requiring prolonged mechanical ventilation. *Crit Care Med.* 2008;36:2061–9.

M.M. Capeletti^a, A.L. Mezzaroba^a, F. Morakami^a,
M.T. Tanita^a, J. Festti^b, C.M.D. de Maio Carrilho^b,
L.T.Q. Cardoso^b, C.M. Carvalho Grion^{c,*}

^a *Intensive Care Division, Hospital Universitário Regional do Norte do Paraná, Universidade Estadual de Londrina, Paraná, Brazil*

^b *Department of Clinical Medical, Universidade Estadual de Londrina, Paraná, Brazil*

^c *Divisão de Terapia Intensiva, Department of Clinical Medical, Universidade Estadual de Londrina, Paraná, Brazil*

* Corresponding author.

E-mail address: cintiagrion@hotmail.com
(C.M. Carvalho Grion).