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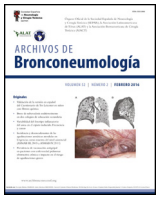

Original article

Age-adjusted Charlson Comorbidity Index Does Not Predict Outcomes in Patients Submitted to Noninvasive Ventilation

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ABSTRACT

Introduction: Comorbidities are thought to have prognostic impact on outcomes of patients submitted to noninvasive ventilation (NIV). Our goal was to determine if age-adjusted Charlson comorbidity index (ACCI) could predict outcomes in patients undergoing NIV due to acute respiratory failure.
Methods: Patients in respiratory failure submitted to NIV were prospective evaluated comparing patient's characteristics and outcomes according to ACCI ≤ median vs. ACCI > median. Each comorbidity composing the index was tested as predictor of NIV failure and readmission/mortality risk at 30 and 90 days, using logistic regression analysis. NIV failure was defined as need for invasive mechanical ventilation and/or death.
Results: 177 patients were enrolled. Median ACCI score was 5 points. Comparing patients with ACCI > 5 with ACCI ≤ 5, the former group was older but APACHE II was similar. Time to first NIV disconnection was inferior for ACCI > 5 patients (OR 0.46, 95% CI 0.23–0.89, $p = 0.021$), after gender and age adjustment. No differences were found in length of stay, time on NIV, NIV complications or failure, and 30 and 90-day hospital readmission or death, before and after adjustment. None of the single comorbidities was predictive of NIV failure and readmission risk, when adjusted to sex and age.
Conclusion: ACCI is not a good predictor for short and medium-term outcomes in patients submitted to NIV.

El índice de comorbilidad de Charlson ajustado por edad no predice los resultados de pacientes sometidos a ventilación no invasiva

Palabras clave:
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Índice de comorbilidad de Charlson ajustado por edad
Insuficiencia respiratoria
Resultados
Ventilación no invasiva
Ancianos

RESUMEN

Introducción: Las comorbilidades parecen tener un impacto en el pronóstico de los resultados de pacientes sometidos a ventilación no invasiva (VNI). Nuestro objetivo fue determinar si el ajuste por edad del índice de comorbilidad de Charlson (ICC) podía predecir los resultados de aquellos pacientes sometidos a VNI por insuficiencia respiratoria aguda.
Métodos: Se evaluaron de forma prospectiva pacientes con insuficiencia respiratoria sometidos a VNI, comparando las características de los pacientes y sus resultados valorados como ICC < mediana vs. ICC > mediana. Mediante un análisis de regresión logística, cada comorbilidad incluida en el índice se evaluó como predictor de fracaso de VNI y de riesgo de reingreso/mortalidad a los 30 y 90 días. Se definió fracaso de VNI como la necesidad de ventilación mecánica asistida y/o muerte.

Abbreviations: NIV, noninvasive ventilation; ACCI, age-adjusted Charlson comorbidity index; CCI, Charlson comorbidity index; COPD(e), chronic obstructive pulmonary disease (exacerbation); ACPE, acute cardiogenic pulmonary edema; APACHE, Acute Physiology and Chronic Health Evaluation; RR, relative risk; OR, odds ratio; AIDS, acquired immunodeficiency syndrome; BMI, body mass index; IPAP, inspiratory positive airway pressure; EPAP, expiratory positive airway pressure; IMV, invasive mechanical ventilation.

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Resultados: Se incluyeron 177 pacientes. La mediana del valor del ICC fue de 5 puntos. En la comparación de pacientes con ICC > 5 frente a pacientes con ICC ≤ 5, el primer grupo resultó ser el de mayor edad, aunque la clasificación por APACHE II fue similar. El tiempo hasta la primera desconexión de VNI fue inferior en pacientes con ICC > 5 (OR: 0,46; IC 95%: 0,23-0,89; p = 0,021), tras el ajuste por género y edad. No se encontraron diferencias en la duración de la hospitalización, el tiempo con VNI, complicaciones o fracaso de la VNI y el reingreso hospitalario o la muerte a los 30 y 90 días, antes y después del ajuste. Ninguna de las comorbilidades analizadas era predictora de fracaso de la VNI o del riesgo de reingreso cuando se ajustaron por sexo edad.
Conclusión: El ICC no es un buen predictor de los resultados a corto y medio plazo de pacientes sometidos a VNI.

Introduction

Non-invasive ventilation (NIV) has changed the outcomes and prognosis of patients in respiratory failure and is now considered a first line treatment for acute hypercapnic respiratory failure. There is strong evidence that the addition of NIV to standard care improves outcomes in patients with chronic obstructive pulmonary disease exacerbation (COPDe) and acute cardiogenic pulmonary edema (ACPE)[1,2] and the technique has been used to support successfully patients with acute respiratory failure from other aetiologies.[3] The success rate can reach 85%[2–5] and is shown to reduce the need for invasive mechanical ventilation, hospital length of stay and in-hospital mortality.[6,7] Treatment with bilevel-positive airway pressure results in faster improvement in the PaO_2/FiO_2 ratio, subjective dyspnea score, respiratory and heart rates, and metabolic disturbances compared with oxygen alone.[3,6,8,9] Recently, high-flow oxygen was described as an alternative to NIV in acute hipoxemic respiratory failure, but its use is not widespread.[10] Due to its proven benefits, the use of NIV to treat COPDe increased more than 400% between 1998 and 2008.[4]

However, rates of failure, usually defined as need for invasive mechanical ventilation and death, are still significant.[11,12] Identification of patients in whom NIV would be unsuccessful, either for causing delay in intubation or inducing unnecessary distress in poor prognostic cases, is determinant. Recent studies have evaluated the impact of prognostic factors in NIV-submitted patients such as severity of acute respiratory failure[11,13] the response in the first hours of treatment,[6,14] Acute Physiology and Chronic Health Evaluation (APACHE) II score[13–15] and biomarkers.[14,15]

Comorbidities prevalence increases markedly with aging and is thought to have a prognostic impact. Several scores have been designed to evaluate their impact. Charlson comorbidity index (CCI) is a predictive score of 10-year mortality rate composed by specific comorbidities.[16] As age is a known risk factor for medical outcome, in 1994 was published age-adjusted Charlson comorbidity index (ACCI), a score designed to evaluate peri-operative risk complications and long-term prognosis.[17] Several studies have reported the accuracy of CCI to determine risk of complications and mortality.[18–20]

Whether the presence of chronic comorbidities could influence NIV success and short and medium-term related mortality was only partially investigated.[21,22] Our aim is to prospectively evaluate the ACCI as a predictor of outcomes in patients submitted to NIV and determine if this tool could help to decide which patients could benefit more from the therapy.

Patients and methods

This is a prospective observational study of a cohort of patients admitted to an Intermediate Care Unit of a tertiary institution, submitted to NIV for acute medical illness between September 2014 and December 2016. We included patients with 18 or more years and accepted all causes of respiratory failure. Patients submitted to invasive mechanical ventilation in which NIV was used for weaning were excluded.

Data collection

Data was collected from patients and medical records. Demographic data, comorbid illnesses, physical examination data, blood tests at start on NIV, etiology of respiratory failure, ventilatory parameters, time to first disconnection, days on NIV, and length of stay were record. Order to "do not intubate" was collected with the patient's medical team, without any investigators intervention on the decision.

Age-adjusted Charlson comorbidity index

The overall comorbid status of each patient was quantified using the ACCI,[17] which is a summation score, age adjusted, based on 19 medical conditions with varying points assigned. A score of 1 is given to each of the following conditions: myocardial infarction, cardiac failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease, peptic ulcer disease, mild liver disease, and diabetes without organ damage; a score of 2 for: hemiplegia, moderate to severe renal disease, any tumor within last 5 years, lymphoma, leukemia and diabetes with organ damage; a score of 3 for: moderate to severe liver disease; and a score of 6 for metastatic solid tumor and acquired immunodeficiency syndrome. Each decade of age ≥50 years is equivalent to a 1-point increase in the score. A value of 0 indicates no comorbidity, while higher values represent an increasing burden of comorbid illnesses. The relative risk of death for each decade of age is 1.42 and for each increasing comorbidity rank was 1.46, with a combined risk of 1.45 for each point in the rank. Relative risk (RR) of mortality increases with ACCI score: 0 point = RR 1, 1 point = RR 1.45, 2 points = RR 2.10, 3 points = RR 3.04, 4 points = RR 4.40, 5 points = RR 6.38, 6 points = RR 9.23, 7 points = RR 13.37, ≥8 points = RR 19.37. As we expect to find high comorbidity burden in our population, we used the median AACI as the cut-off for comparing patients with "low" risk (ACCI ≤ median) and "high" risk (ACCI > median) profiles.

Outcomes and study endpoints

Prognosis was assessed comparing complications between groups during hospitalization (NIV intolerance, mask associated facial ulcers, aspiration, need for invasive mechanical ventilation, death and others) and after discharge (readmission/time to readmission and death/time to death at 30 days and 90 days). Time to first disconnection, NIV days, and length of stay (total and after NIV) were also accessed.

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