Med Intensiva. 2012;36(7):475–480

medicina intensiva

www.elsevier.es/medintensiva

ORIGINAL

Usefulness of procalcitonin clearance as a prognostic biomarker in septic shock. A prospective pilot study☆

J.C. Ruiz-Rodríguez[a,*], J. Caballero[a], A. Ruiz-Sanmartin[a], V.J. Ribas[b], M. Pérez[a], J.L. Bóveda[a], J. Rello[c]

[a] *Servei de Medicina Intensiva, Grup de Recerca de Shock, Disfunció Orgànica i Ressuscitació (SODIR), Hospital Universitari Vall d' Hebron, Vall d'Hebron Institut de Recerca (VHIR), Universitat Autònoma de Barcelona, Barcelona,, Spain*
[b] *Departament de Llenguatges i Sistemes Informàtics, Universitat Politècnica de Catalunya, Edifici Omega, Campus Nord, Barcelona, Spain*
[c] *Servei de Medicina Intensiva, Clinical Research and Innnovation in Pneumonia & Sepsis (CRIPS), Hospital Universitaria Vall d' Hebrón, Vall d' Hebron Institut de Recerca (VHIR), Universitat Autònoma de Barcelona, CIBER Enfermedades Respiratorias, Barcelona, Spain*

Received 28 October 2011; accepted 21 November 2011
Available online 16 January 2012

KEYWORDS
Procalcitonin;
Severe sepsis;
Multiple organ dysfunction syndrome;
Biomarker;
Prognosis

Abstract
Objective: To evaluate procalcitonin clearance as a prognostic biomarker in septic shock.
Design: Prospective, observational pilot study.
Setting: Intensive care unit.
Patients: Patients admitted to the ICU due to septic shock and multiorgan dysfunction.
Interventions: Serum concentrations of procalcitonin were determined within 12 h of onset of septic shock and multiorgan dysfunction (coinciding with admission to the ICU), and the following extractions were obtained after 24, 48 and 72 h in patients who survived.
Data collected: Demographic data, Acute Physiology and Chronic Health Evaluation II score, and Sequential Organ Failure Assessment score, data on the primary focus of infection, and patient outcome (ICU mortality).
Results: Procalcitonin clearance was higher in survivors than in non-survivors, with significant differences at 24 h (73.9 [56.4–83.8]% vs 22.7 [−331–58.4], $p < 0.05$) and 48 h (81.6 [71.6–91.3]% vs −7.29 [−108.2–82.3], $p < 0.05$). The area under the ROC curve was 0.74 (95%CI, 0.54–0.95, $p < 0.05$) for procalcitonin clearance at 24 h, and 0.86 (95%CI, 0.69–1.0, $p < 0.05$) at 48 h.
Conclusions: ICU mortality was associated to sustained high procalcitonin levels, suggesting that procalcitonin clearance at 48 h may be a valuable prognostic biomarker.

☆ Prior presentation: Reported in part in abstract form at the 23rd Annual Congress of European Society of Intensive Care Medicine (October, 2010, Barcelona, Spain).

* Corresponding author.
E-mail address: jcruiz@vhebron.net (J.C. Ruiz-Rodríguez).

0210-5691/$ – see front matter
doi:10.1016/j.medin.2011.11.024

PALABRAS CLAVE
Procalcitonina;
Sepsis grave;
Síndrome de disfunción multiorgánica;
Biomarcardor;
Pronóstico

Utilidad del aclaramiento de procalcitonina como biomarcador pronóstico del shock séptico. Estudio piloto prospectivo

Resumen
Objetivo: Evaluar el aclaramiento de procalcitonina como biomarcador pronóstico del shock séptico.
Diseño: Estudio piloto, observacional y prospectivo.
Ámbito: Servicio de Medicina Intensiva.
Pacientes: Enfermos ingresados en el Servicio de Medicina Intensiva por shock séptico y disfunción multiorgánica.
Intervenciones: Determinación de las concentraciones séricas de procalcitonina en las primeras 12 h de evolución del shock séptico (coincidiendo con el ingreso en el Servicio de Medicina Intensiva) y posteriormente a las 24 horas, 48 horas y a las 72 horas en los pacientes supervivientes.
Variables recogidas: datos demográficos, score Acute Physiology and Chronic Health Evaluation II, score Sequential Organ Failure Assessment, datos relativos al foco de sepsis y al resultado del paciente (mortalidad en el Servicio de Medicina Intensiva).
Resultados: El aclaramiento de procalcitonina fue mayor en los pacientes supervivientes respecto a los no supervivientes, con diferencias significativas a las 24 horas (73,9 [56,4−83,8]% vs 22,7 [−331−58,4], $p < 0,05$) y las 48 horas (81,6 [71,6−91,3]% vs −7,29 [−108,2−82,3], $p < 0,05$). El área por debajo de la curva ROC fue 0,74 (IC del 95%, 0,54 a 0,95, $p < 0,05$) para el aclaramiento de procalcitonina a las 24 horas y 0,86 (IC del 95%, 0,69 a 1,0, $p < 0,05$) para el aclaramiento de procalcitonina a las 48 horas.
Conclusiones: La persistencia de concentraciones elevadas de procalcitonina se asoció a una mayor mortalidad. El aclaramiento de procalcitonina realizado a las 48 h puede ser de utilidad como biomarcador pronóstico.

Introduction

Procalcitonin (PCT) has been proposed as a specific biomarker of bacterial infectious[1–3] and has been related to the severity of sepsis.[4] In healthy subjects, PCT concentrations are undetectable or very low (0.1−0.5 ng/ml). While in colonization, local infection or viral infection PCT levels remain below 2 ng/ml, in sepsis levels they often rise above 3 ng/ml, and in septic shock (SS), PCT levels are even higher.[5]

PCT has been widely studied in patients with pneumonia[6–13] as a biomarker to reduce the duration of antibiotic treatment,[14–16] but no studies have investigated its evolutionary behavior specifically in patients with septic shock (SS) and multiorgan dysfunction (MODS).

The hypothesis of this study was that the evolutionary kinetics of PCT and the persistence of high PCT levels may have prognostic value and may be useful in clinical monitoring of patients with SS and MODS. PCT was determined sequentially in all patients, all with severe sepsis and MODS, in order to study the behavior of PCT levels during SS and MODS, to introduce the concept of PCT clearance (PCT-c) as a tool to assess its kinetics and to analyze its potential value as a prognostic biomarker.

Materials and methods

Study setting and population

A prospective, observational cohort study of adult patients (over 18 years) was performed. The patients were admitted to the ICU for SS and MODS in the first 12 h of SS evolution. SS and MODS were defined according to the recommendations of the 2001 International Sepsis Definitions Conference.[17] The study was conducted at a single center, the Critical Care Department of the Vall d'Hebron University Hospital (VH-ICU, Barcelona, Spain). VH-ICU is a medical-surgical unit with 36 beds for critically ill patients. Attending physicians are all specialists in Intensive Care Medicine, with a minimum of five years' specialized training. All patients were admitted to VH-ICU. All patients with SS were resuscitated following our department's protocol, based on the recommendations of the Surviving Sepsis Campaign[18] and the American College of Critical Care Medicine guidelines for hemodynamic support of adult patients with sepsis.[19] Sepsis management was similar in all patients. A source control was performed within the first 12 h of SS development, except in one patient with endocarditis (in whom mitral valve replacement was performed 24 h after development of shock). The study was approved by the Clinical Research Ethics Committee of the hospital and the need for informed consent was waived.

Data collection

The following variables were compiled for all patients: age, sex, Acute Physiology and Chronic Health Evaluation (APACHE)-II score and Sequential Organ Failure Assessment (SOFA), data on the primary focus of infection, and culture results. The APACHE-II score, SOFA and number of dysfunctional organs were calculated on ICU admission, and always within 12 h of onset of SS and MODS. Organ dysfunction was defined as a SOFA score of 1 or more.[20] Patient outcome (ICU mortality) was assessed retrospectively, without knowledge of PCT levels.