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ORIGINAL ARTICLE

Prognostic value of lactate clearance in severe community acquired pneumonia



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KEYWORDS

SCAP;
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Abstract *Introduction:* Severe community acquired pneumonia (SCAP) occurs in approximately 18–36% of all CAP and the mortality rate could be as high as 67% in patients with SCAP. Several studies have described a correlation between baseline lactate concentration and mortality of ICU patients.

Aim of the work: To follow lactate clearance after admission for 24 h which could be an indicator of outcome in severe community acquired pneumonia.

Patients and methods: Forty-six consecutively admitted adult patients were diagnosed as severe community acquired pneumonia. Lactate was measured at the time of admission (H0), reassessment of lactate level was done after 8 h and also another lactate measurement done after 24 h. In a trial to follow the guideline for management and to optimize oxygen delivery (DO₂) and reach a ScvO₂ ≥ 70%, ScvO₂ was measured through a central venous blood sample done at the same time with lactate. During the study resuscitation by inotropic medications and patient's physiological parameters were measured routinely. All data needed to calculate the Acute Physiology and Chronic Health Evaluation (APACHE II) score were recorded.

Results: Most of patients in the current study were above the age of 60 years. Twenty-five patients had lactate clearance of more than 40%, those patients were included in group I, whereas 21 had lactate clearance of 40% or less and they were included in group II. There was no significant difference in the age and sex distribution between both groups. Out of 21 patients included in group II, inotropic drugs were used in 8 patients (38%), whereas there was one patient only in group I. The rate of intubation in addition to the mean APACHE II score and ICU length of stay was significantly higher in group II compared to group I. Over the first 24 h three readings for mixed venous oxygen were recorded and included in the analysis. The reading of mixed venous oxygen recorded after 24 h of ICU admission was significantly high in group I. All indices of blood lactate

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clearance over the first 24 h were higher in group I compared to group II, however it was only significantly high after 24 h (p -value 0.01).

Conclusion: Our study suggests that lactate clearance could be used as a useful biomarker which is inexpensive and a reliable predictor of patient outcome in critically ill patients admitted to ICU with severe community-acquired pneumonia.

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Introduction

Patients admitted with severe pneumonia in the intensive care unit (ICU) represent a major concern for physicians because of the high mortality and morbidity rate attributable to these episodes [1–3]. Severe community acquired pneumonia (SCAP) occurs in approximately 18–36% of all CAP [3]. The mortality rate for community acquired pneumonia (CAP) is < 5% for outpatient cases, it rises to 10% in admitted ward patients and can exceed 30% in patients admitted to intensive care unit (ICU) [4]. Tan et al. and Hirani et al. reported a mortality rate of 67% and 58% in patients with SCAP, respectively [1,5]. A lot of effort was focused upon the need for a best definition that could predict illness severity [6]. In 1993, the American Thoracic Society (ATS) proposed a definition of severe CAP requiring ICU admission [7]. Since that time, these criteria have been updated twice [8,9]. Liapikou et al. describes a nicely performed study that validates the IDSA/ATS prediction rule when it comes to major criteria but fails to confirm the validity of the minor criteria [10]. These findings are acceptable but are not very surprising, and it is incumbent upon investigators to continue to explore the usefulness of the minor criteria [11]. On the other hand Angus et al. concluded that none of the available prediction rules for severe CAP were adequately robust to guide clinical care at the current time [6]. During past decades many strategies have been implemented with the aim to optimize the outcome of patients with severe lung infections, and it is widely believed that in critically ill patients, when oxygen delivery fails to meet oxygen demand, an oxygen debt with global tissue hypoxia ensues [11,12]. As the condition became more complicated such as in severe sepsis and septic shock the lactate concentration increased. This increase in lactate is the result of an anaerobic production (via the Na–K ATPase channel) and a decrease in lactate utilization [13–15]. Lactate clearance, measurement of the lactate level at two consecutive times, is an inexpensive and simple clinical parameter that can be obtained by a minimally invasive means [16–18]. This parameter represents kinetic alteration of the anaerobic metabolism that makes it a potential parameter to evaluate disease severity and intervention adequacy. Lactate clearance early in the hospital course may indicate a resolution of global tissue hypoxia and is associated with improved outcome [19].

In addition, several studies have described a correlation between baseline lactate concentration and mortality of ICU patients [20–23]. In this study we follow lactate clearance after admission for 24 h which could be an indicator of outcome in severe community acquired pneumonia. So, we investigated the prognostic value and the clinical utility of lactate clearance in the intensive care unit during the period of disease presentation.

Aim of the work

To study the prognostic value and the clinical utility of the lactate clearance in intensive care unit as a marker for predicting poor outcomes in patients with severe pneumonia.

Patients and methods

This study was conducted prospectively between October 2012 and January 2014 at the Critical Care department of the Cairo University. This study was approved by the local ethics committee of the department and a written consent from the patient or next of kin was required. Forty-six consecutively admitted adult patients diagnosed as severe community acquired pneumonia depending on the Infectious Disease Society of America–American Thoracic Society guidelines with the revised American Thoracic Society criteria. This guideline comprises two major criteria (the requirement for mechanical ventilation and vasopressor support) or three minor criteria (comprising respiratory rate, $\text{PaO}_2/\text{FiO}_2$ ratio, multilobar infiltrates, confusion, uraemia, leucopenia, thrombocytopenia, hypothermia and hypotension requiring aggressive fluid resuscitation) [9].

For all patients included in the study, full history and clinical examination were performed regularly. Laboratory work up including blood picture, sputum and blood culture was requested. Other investigations including arterial blood gases and chest X-rays were done for all patients in the study. All patients were invasively monitored with a central venous catheter capable of taking blood samples (superior vena cava) for measuring mixed venous blood which was measured when patients arrived in ICU and after 8 and 24 h. Appropriate specimens were taken for culture, and antibiotics were administered as soon as possible. Blood pressure was monitored by either a non invasive automated cuff sphygmomanometer or an arterial catheter according to the clinical team's judgement.

The inclusion of the patient in this study was initiated at the time of ICU admission (H_0), with lactate measurement. Reassessment of lactate level was done after 8 h and also another lactate measurement after 24 h. In a trial to follow the guideline for management and to optimize oxygen delivery (DO_2) and reach a $\text{ScvO}_2 \geq 70\%$, ScvO_2 was measured through a central venous blood sample done at the same time with lactate. Lactate clearance was defined by the equation $[(\text{lactate initial} - \text{lactate delayed})/\text{lactate initial}] \times 100\%$. Survival was followed-up during 28 days. During the study resuscitation by inotropic medications, the patient's physiological parameters were measured routinely. All data needed to calculate the Acute Physiology and Chronic Health Evaluation (APACHE II) score were recorded.

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