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Does the time of onset of severe sepsis in a surgical intensive care unit influence mortality rates: a single-center retrospective analysis

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Abstract

Purpose: The purpose of this study was to investigate possible differences in characteristics and mortality rates between early- and late-onset severe sepsis in surgical intensive care unit (ICU) patients.

Materials and Methods: Prospectively collected data from all adult patients (>18 years) admitted to our 50-bed surgical ICU between 1st March 2004 and 30th July 2006 were analyzed retrospectively.

Results: Of 5925 patients admitted during the study period, 234 patients (3.9%) had severe sepsis: 74 (31.6%) early onset and 160 (68.4%) late onset. Respiratory infections (48.1 versus 27.0%, $P = .002$) and infections of unknown origin (21.9 versus 12.2%, $P = .005$) were recorded more frequently in patients with late-onset than in those with early-onset severe sepsis; abdominal infections were more frequent in early-onset than in late-onset severe sepsis (20.3% versus 7.5%, $P = .005$). Gram-positive infections were more frequent in late-onset than in early-onset severe sepsis (63.1 versus 51.4%, $P = .036$). The time of onset of severe sepsis was not independently associated with an increased risk of ICU (early versus late: odds ratio, 1.1; confidence interval, 0.78-0.59; $P = .786$) or in-hospital (early versus late: odds ratio, 0.68; 95% confidence interval, 0.36-1.29; $P = .689$) death.

Conclusions: Patterns of infection are different in patients with early-onset and those with late-onset severe sepsis. The time of onset of severe sepsis in surgical ICU patients has no impact on mortality. These data may be important in risk stratification and may be useful in resource allocation in the ICU.

1. Introduction

Sepsis, a systemic inflammatory response occurring as a result of infection, occurs frequently in critically ill patients, being reported in almost 40% of intensive care unit (ICU) patients [1]. Many patients with infection are referred to the ICU from extended care facilities, the emergency room, or general wards and already have sepsis syndrome on ICU admission [2]. In other critically ill patients, such as those experiencing severe accidental or operative trauma, sepsis is a later occurrence during the hospitalization course. Profoundly debilitated "chronically ill patients" who have

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survived their acute phase illness may also develop serious complications while in the ICU, including severe forms of sepsis syndromes, as a result of derangements in immune function [3].

The possible relation between the time of onset of severe sepsis and outcome is unclear. In large multicenter studies, late onset of severe sepsis or septic shock has been associated with an increased risk of death [4,5]. However, the heterogeneity of patient populations and possible variability in ICU organization and management strategies between ICUs may hinder the extrapolation of these results of multicenter studies to other ICU patients with a different case-mix [6]. The possible impact of the time of onset of severe sepsis after ICU admission and outcome in surgical ICU patients has not previously been investigated. Such data may be important in risk stratification and may be useful for resource allocation in the ICU.

The aim of our study was, therefore, to investigate possible differences in characteristics of and mortality rates in surgical ICU patients with early- versus late-onset severe sepsis.

2. Methods

The institutional review board of Friedrich Schiller University Hospital, Jena, Germany, approved the study. Informed consent was waived due to the retrospective anonymous nature of the analysis. We included all consecutive adult (>18 years old) patients admitted to our 50-bed surgical ICU between 1st March 2004 and 30th July 2006. For patients admitted more than once to the ICU, only the first admission was considered.

2.1. Data collection

Data were collected from vital sign monitors, ventilators, and infusion pumps and automatically recorded by a clinical information system (Copra System GmbH, Sasbachwalden, Germany). The clinical information system provides staff with complete electronic documentation, order entry (eg, medications) and direct access to laboratory results. Data recorded prospectively on admission included age, sex, referring facility, primary and secondary admission diagnoses, and surgical procedures. Admission diagnosis was categorized retrospectively on the basis of prospectively recorded codes from the *International Classification of Diseases-10* and electronic patient charts. Microbiologic and clinical infectious data were collected on a daily basis.

The Simplified Acute Physiology Score (SAPS) II [7] and the Sequential Organ Failure Assessment (SOFA) [8] scores were calculated daily by the physician in charge of the patient using a special sheet. Components of each score were transmitted automatically to a special sheet on the patients' electronic charts. The automatically transmitted data were checked for plausibility by visual inspection by the attending physician before calculating the final scores. Electronic reminders were used to ensure completeness of data, and the electronic charts were checked by a senior attending physician before final registration. Hospital mortality and hospital discharge dates were available for all patients from electronic hospital records.

2.2. Definitions

Comorbidities were defined according to the definitions provided in the original SAPS II paper [7]. Planned admission was defined as an admission after elective surgery, which was planned 24 hours before the surgical procedure.

Sepsis syndromes were defined according to consensus conference definitions [9] and were recorded daily by the attending physician in a special section of the electronic records. Presence of infection was assessed on the basis of clinical history, symptoms, physical examination, and laboratory findings. Clinically documented infection was defined as a known or strongly suspected source of infection (identified anatomically and/or by imagery and/or histologic evidence) requiring administration of antimicrobial therapy, but without microbiologic confirmation. Microbiologically documented infection was defined as infection supported by positive cultures of blood or body fluid. Organ failure was defined according to the recommendations of the German Sepsis Society [10]. Central nervous system failure was defined as disturbed consciousness, irritability, disorientation, delirium without evidence of drug-induced manifestations; thrombocytopenia as platelet count less than $100 \times 10^3/\mu L$ or more than 30% decline within 24 hours without evidence of blood loss as an etiologic factor; respiratory failure as PaO_2 less than 75 mm Hg in room air, PaO_2/FiO_2 less than 250 mm Hg; cardiovascular failure as systolic blood pressure less than 90 mm Hg or mean arterial pressure less than 70 mm Hg for at least 1 hour despite adequate fluid resuscitation; renal failure as urinary output less than 0.5 mL kg^{-1} h^{-1} for at least 1 hour in the absence of hypovolemia or a 2-fold increase in serum creatinine; and metabolic acidosis as base excess less than -5 mEq L^{-1} or a plasma lactate concentration 1.5 times above the reference value.

2.3. Subgroups

Patients with severe sepsis or septic shock were divided into 2 groups according to the time of diagnosis: early-onset severe sepsis for those diagnosed with severe sepsis or septic shock within 48 hours after ICU admission and late-onset severe sepsis for patients developing severe sepsis or septic shock more than 48 hours after ICU admission.

2.4. Statistical analysis

Data were analyzed using SPSS 13.0 for windows (SPSS Inc, Chicago, Ill). Descriptive statistics were computed for