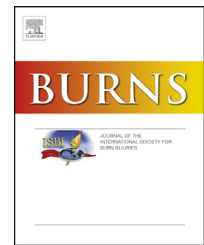


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Epidemiology and outcome analysis of sepsis and organ dysfunction/failure after burns

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ABSTRACT

Background: The aim of this prospective study in adult population is to give frequency data (prevalence, incidence) of burn wound sepsis and its consequences (organ dysfunction/failure); to analyze the evolution of the SOFA cumulative score during the disease and relationship between the SOFA score in the 3rd, 7th, 14th and 21th day after burn with mortality.

Method: A prospective cohort study was performed among adult patients (age ≥ 20 years) admitted in the ICU, with major and moderate burns. Sepsis, organ dysfunction, organ failure and mortality were calculated as Cumulative Incidence (CI) and as Incidence rate (IR). Data from patients with sepsis were compared with those without sepsis. Evaluation of SOFA evolution was done with delta score and the influence of the SOFA score in mortality was calculated with AUC of the ROC curve.

Results and conclusions: Period prevalence of sepsis in our adult burned population was 26%. Incidence proportion as CI was 0.3 or 30 patients per 100 adults. Incidence rate (IR) was 6 patients with sepsis per 100 patient-years. Overall morbidity was 88.1% while overall mortality was 11.9%. Mortality in patients with sepsis was 34.4%. Incidence of MOD was 63% while incidence of MOF was 37%. Respective mortality as CI was 7% and 81% while mortality rate as IR was 1.4 per 100 patient-years in patients with MOD and 16.2 per 100 patient-years in patients with MOF. SOFA-3 should be considered a "reliable indicator" at separating survivors from non survivors and SOFA 7, 14, and 21 should be considered excellent in predicting mortality.

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1. Introduction

Sepsis, as a lethal disease process, is a major public health concern with the mortality rate depending on the severity of the illness from 30% to 50% [1,2]. Definitions of sepsis, septic shock and organ dysfunction have changed during years in

1992 (Sepsis-1), in 2001 (Sepsis-2) and recently in 2016 (Sepsis-3) [3-5]. Recommendations of experts support the use of the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score as one of the scoring systems with a predictive validity for in hospital mortality in ICU encounters with suspected infection and sepsis [6-8]. In Sepsis-3 experts recommended new measure: qSOFA (for quick SOFA) as simple bedside

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criteria to identify patients who are likely to have poor outcome [5].

Sepsis and consequences of the systemic response to injury like Multiple Organ Dysfunction (MOD) and/or Multiple Organ Failure (MOF) are considered as the main reasons of mortality in burned patients [9,10]. The American Burn Association (ABA) in 2007 has developed and published standardized definitions for sepsis and infection-related diagnoses in the burn population [11]. Although in some studies classification criteria are not really reflecting outcomes, application of these definitions to the clinical setting must take into account the complex nature of the sepsis disease process [12,13]. There is compliance with ABA definitions and Sepsis-3 definitions regarding the fact that the term “severe sepsis” was redundant [3,11].

Recommendations of ABA experts regarding the SOFA scoring system consist in the importance of identification of patients with organ dysfunction as early as possible after the acute resuscitation period is over. The SOFA score should represent the maximum daily score (i.e., the overall worst score). Rationale for using worst cumulative score is that different organs fail at different times and it is the cumulative insult that is important in determining the prognosis of individual patients as well as patient populations [11].

From the database of our Service of Burns in University Hospital Center Tirana, Albania and from our modest studies during years, we are based on definitions of Sepsis-1 and then on ABA definitions. We have noticed that in our Service we have had improvements in overall mortality from 25% in 1992 up to 8% in 2015 and also in the Incidence proportion of burn wound sepsis from 37.1% in 1992 up to 14.6% in 2015 and during the last years we have noticed a predomination of burn wound sepsis in adults compared with children. Despite the decrease of mortality in sepsis from 42.8% in 1992 up to 31.8% in 2015, handling it is still a real challenge for our unit [14-17].

The purpose of the study is:

- To analyze the frequency (prevalence, incidence) of burn wound sepsis and “natural history” of sepsis in adult population including organ dysfunction/failure.
- To analyze the morbidity and mortality rate in adult patients with burn sepsis.
- To measure the changes of organ dysfunction/failure scores over time by SOFA score and to analyze the evolution of the SOFA cumulative score (increase, unchanged or decrease) during the course of the disease.
- Our clinical question is whether there is any relationship between the SOFA score in the 3rd, 7th, 14th and 21th day after burn and mortality.

2. Method

This study was approved by the institutional review board of the University Hospital Center “Mother Teresa” Tirana, Albania.

2.1. Study design, settings and population

A prospective cohort study was performed among adult patients (age ≥ 20 years) admitted in the ICU, with major and

moderate burns (classified according to ABA referral criteria) during the 5-year period from January 1, 2010 to December 31, 2014. Concretely patients were diagnosed with partial thickness burns greater than 20% of TBSA, burns in critical parts of the body, third degree burns, electrical and chemical burns, inhalation injury as well as burns in patients with preexisting medical disorders and with concomitant trauma.

Patients excluded from the study are children and non burn related admissions like among others Steven Johnson/Toxic Epidermal Necrolysis, Necrotizing Fasciitis and chronic wounds. Burn Surface Area (BSA) was calculated as the percentage of total body surface area according to the Lund & Browder Chart [18].

Patients were hospitalized in ICU firstly by initial assessment of their burn surface area, depth of burn, and clinical situation. After resuscitation phase and reevaluation of thickness of burn wound as well as after a clinical control, a part of patients are discharged in the ward. All the rest are considered severe patients because of the complexity of the burn disease. In order to fulfill the objectives of the study which required precise definitions, our population of patients with burns which complete their hospitalization during the study period in ICU, will properly be called “critical patients”.

The cohort included all the patients hospitalized in the ICU of the burn service. From 346 patients screened, 293 met the eligibility criteria mentioned earlier while 53 patients (15 deaths) were discharged from the ICU.

From them, based on clinical criteria of sepsis, we observed in total 203 patients (4 deaths) without sepsis and 90 patients (31 deaths) with sepsis. The way we have analyzed our data is described in the patient selection, flow chart (Fig. 1). The patients were grouped according to the length of hospital stay (LOS) in four groups. In group 1 there were 78 patients with LOS 3-6 days; in Group 2 there were 110 patients with LOS 7-13 days; in Group 3 there were 41 patients with LOS 14-20 days and in Group 4 remained 64 patients with LOS more than 21 days.

We firstly removed 53 patients with LOS 1-2 days. These first two days correspond with the resuscitation period of burn shock. Here were included 15 deaths from the burn shock and the others were patients hospitalized in ICU only for the period of resuscitation. It was clearly showed that 78 patients with LOS 3-6 days had scoring only for SOFA 3. After that, we removed 110 patients with LOS 7-13 days which had scoring for SOFA 3 and SOFA 7. Of the remaining number of patients we have removed 41 patients with LOS 14-20 days which had scoring for SOFA 3, SOFA 7 and SOFA 14. The last 64 patients with a LOS of more than 21 days had a measured SOFA of the following days 3, 7, 14, 21. We pooled the patients in four main groups according to LOS in order to facilitate our analysis. Concretely, the SOFA score and mortality were compared based on the ROC curves of the 4th group. To evidence any change in the SOFA cumulative score (increase, stalemate or decrease) we analyzed the data of the patients in group 2, 3 and 4.

2.2. Defining cohort with sepsis

Sepsis was defined according to ABA Consensus Panel Publication for Infection and Sepsis [9].

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