Archives of Anesthesiology and Critical Care (Spring 2023); 9(2): 126-131.

Available online at http://aacc.tums.ac.ir

Research Article

The Outcome of Sepsis Patients Admitted to the Surgical Intensive Care Unit

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ARTICLE INFO

Article history:
Received 23 March 2022
Revised 13 April 2022
Accepted 27 April 2022

Keywords:
Caudal;
Pediatric;
Postoperative;
Fentanyl;
Ropivacaine

ABSTRACT

Background: Although sepsis is one of the leading causes of mortality in hospitalized patients, information regarding early predictive factors for mortality and morbidity is limited. The main objective of this study was to identify the outcome of patients with sepsis and septic shock.

Methods: A prospective observational study was done in a surgical ICU over a period of one year. We included all adult patients admitted to ICU with features of sepsis and septic shock. Data related to demography, co-existing illnesses, parameters to assess Sequential Organ Failure Assessment (SOFA) scores, other relevant laboratory data, source of infection, organ failures and supportive measures instituted were recorded. Patients were followed till discharge or death from the ICU.

Results: 160 patients were included in this study. The mortality rate was significantly higher among females compared with males. The most common co-existing illnesses were hypertension and type II diabetes mellitus. The SOFA scores at admission were high among non-survivors. Older age, presence of anaemia (defined as haemoglobin less than 13 g/dL in males and 12 g/dL in females), renal dysfunction (creatinine level more than 1.3 g/dL), and acute respiratory distress syndrome (ARDS) were associated with higher mortality. Haematocrit, total leucocyte count, serum bilirubin and SOFA scores were significantly higher among non-survivors.

Conclusion: Our findings suggest that septic shock occurs frequently in ICU patients and mortality remains high. Several critical scoring systems are useful for the early prediction of mortality. A sepsis mortality based on SOFA scores and haemoglobin has greater predictive power.

Sepsis is a major challenge for public health; it is the main cause of morbidity and mortality in intensive care units (ICUs) and is associated with poor outcomes [1-4]. Sepsis has an incidence of 535 incidents per 100,000 person-years in the United States and is on the rise. According to a meta-analysis of data from high-income nations, there will be 31.5 million instances of sepsis and 19.4 million cases of severe sepsis per year worldwide. Sepsis occurred in 29.5% of patients during their time in the intensive care unit (ICU), according to data from the Intensive Care Over Nations (ICON) assessment, with regional rates ranging from 13.6 to 39.3%. The precise death rate is still debatable, despite several studies demonstrating a decrease in sepsis-related mortality over the past 20 years as a result of more sophisticated supportive treatment and the adoption of recommendations [5–10]. Between 1979 and 2000, sepsis-related mortality in the US dropped from 27.8 to 17.9%. Similarly, between 2000 and 2012, mortality in Australia and New Zealand fell by almost half (from 35.0 to 18.4%). The in-hospital mortality rate for patients with septic shock was, however, 50.9% in Germany and 58.6% in Italy, according to a multicenter research [10-11]. Few significant epidemiological studies of sepsis have been conducted to date in middle- and low-income nations. According to the ICON audit, higher

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mortality was linked to lower income. In Turkey, a multicenter point-prevalence research revealed a 30.8% sepsis prevalence and a 75.9% fatality rate for patients in septic shock. China, which has one-fifth of the world's population, is a middle-income nation. Up until now, knowledge of the sepsis epidemiology has been restricted to certain groups or gathered through a cross-sectional research, which might not adequately reflect the sepsis epidemiology in critically sick patients.

SEPSIS, a syndrome of physiologic, pathologic, and biochemical abnormalities induced by infection, is a major public health concern. Sepsis is a common cause of hospitalization and the main cause of death in the intensive care unit (ICU) [1-3]. Severe sepsis and septic shock contribute to significant morbidity and mortality in ICU patients. The mortality rate of sepsis ranges from 30-40% [4-6]. Because the only available therapies for this condition, antimicrobials and supportive care, are not specific, there was little concern about developing more detailed standards for diagnosis [7]. Despite advances over the past two decades, mortality in sepsis remains unchanged [8-9].

In 1992, the American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) jointly published the consensus definitions of sepsis [10]. Many studies have shown that the presence of SIRS is nearly ubiquitous in hospitalized patients and occurs in many benign conditions, both related and not related to infection, and thus is not adequately specific for the diagnosis of sepsis [11]. It is a strength of the consensus definition that it no longer includes SIRS. The European Society of Intensive Care Medicine and the Society of Critical Care Medicine convened a task force of 19 critical care, infectious disease, surgical, and pulmonary specialists in January 2014. The group engaged in iterative discussions via 4 face-to-face meetings between January 2014 and January 2015, email correspondence, and voting. Existing definitions were revisited in light of an enhanced appreciation of the pathobiology and the availability of large electronic health record databases and patient cohort [12]. According to the new definitions, sepsis is now defined as evidence of infection plus life-threatening organ dysfunction, clinically characterized by an acute change of 2 points or greater in the SOFA score [11]. The main aim of our study was to assess the outcome of sepsis in patients admitted in surgical intensive care.

Methods

This prospective observational study was conducted in our hospital after approval by institutional ethical committee. The study included all cases of sepsis admitted in Surgical Intensive Care Unit (SICU) over a period of one year. Patients with sepsis/septic shock admitted to SICU, required intensive treatment and monitoring. All patients over 18 years of age admitted to the SICU were screened for sepsis and septic shock at admission or during their ICU stay as defined by the European Society of Intensive Care Medicine and the Society of Critical Care Medicine [13]. Vital parameters of patients were recorded at the time of admission and during their stay in SICU, which includes GCS, HR, BP, CVP and MAP. All base line investigations including ABG, CBC, KFT, LFT, ECG and X-ray chest were done. Septic profile (blood, urine and endotracheal tube tip cultures) was sent. Sequential Organ Failure Assessment (SOFA) scores were determined. Initial SOFA score was calculated and correlated with mortality and duration of stay in SICU [14]. The patients were followed up until discharge or death. Data related to demography, co-existing illnesses, parameters to assess Sequential Data regarding the source of infection and supportive measures given were also recorded.

Inclusion Criteria

Age group 18 years and above.

Patients admitted to SICU with features of sepsis/septic shock.

Patients who develop sepsis/septic shock during their course of stay in SICU- as per the European Society of Intensive Care Medicine and the Society of Critical Care Medicine [13].

Exclusion Criteria

Age group below 18 years.

Patients who die within 24-hours of admission in SICU.

Patients readmitted to SICU during the same hospital stay.

Pregnancy Immunocompromised states

SPSS statistics were used to conduct the analysis (version 23). Continuous variables with normal distribution were compared using Student t test while those not normally distributed were analysed using Mann Whitney U test. Categorical data were analysed using Chi-square test. Multivariate logistic regression models were used to determine predictors of mortality. A 0.05 p-value was regarded statistically significant, whereas a 0.001 p value was considered statistically very significant.

Results

A total of 160 cases were included in this study according to inclusion criteria. The cases included 86 males and 74 females, with male: female ratio of 1.16 :1. Out of these 160 patients, 82 patients ultimately died in the SICU. Mortality rate was significantly higher among females compared with males, (67.6% and 37.2%, respectively).

The SOFA scores at admission were high among non-survivors.

Table 1- The severity of illness and patient outcomes

Parameters (Mean ± SD)	Non- survivors n=82	Survivors n=78	P value
SOFA score	8.2 ± 2.5	4.9 ± 2.1	< 0.005
Ventilator duration (in days)	3.5 ± 1	2.3 ± 1.1	<0.005
ICU LOS	4.2 ± 1.5	5 ± 1.5	0.023
Ventilator support (%)	110	90	0.01
Vasopressor support (%)	140	60	<0.005

ICU LOS—intensive care unit length of stay; SOFA—sequential organ failure; SD—standard deviation

Total leucocyte count, serum creatinine, serum bilirubin and serum lactate levels were higher among non-survivors compared to survivors.

Table 2- Vital parameters and Laboratory parameters

Parameters (Mean ± SD)	Non- survivors n=82	Survivors n=78	P value
Vital parameters			
Heart rate (beats/min)	109.7 ± 12.2	100.3 ± 13.3	0.059
Mean arterial pressure (mmHg)	79.3 ± 14.5	91.8 ± 22.6	0.082
Laboratory parameters			
TLC (cells/ul)	16709 ± 8656	13768 ± 5206	0.05
PaO2/FiO2 ratio	293.6 ± 48.9	323.5 ± 42	0.068
Serum Creatinine (mg/dl)	2.88 ± 0.9	2.24 ± 0.8	0.029
Serum bilirubin (mg/dl)	5.2 ± 4.3	2.3 ± 1	0.00
Serum lactate (mmol/dl)	3.8 ± 0.6	2.8 ± 0.5	0.00

Older age, presence of anemia (defined as hemoglobin less than 12 g/dL in males and 10 g/dL in females), renal dysfunction (creatinine level more than 1.3 g/dL), and acute respiratory distress syndrome (ARDS) were associated with higher mortality.

Table 3- Determination of mortality predictors by univariate and multivariate analyses

Parameters	Non-Survivors n=82 (%)	Survivors n=78 (%)	P value	Relative Risk (95% CI)
Gender				
Male	32 (37.2)	54 (62.8)		1.0
Female	50 (67.6)	24 (32.4)	0.0029	1.7 (1.2-2.2)
Age (years)				
0-30	12 (37.5)	20 (62.5)		1.0
31-45	16 (53.3)	14 (46.7)	0.428	1.34 (0.6-2.0)
46-60	10 (21.7)	36 (78.3)	0.194	0.5 (0.1-1.2)
>60	44 (84.6)	8 (15.4)	0.001	2.14 (1.5-2.3)
Hemoglobin (g/dl)				
≥12	12 (27.3)	32 (72.7)		1.0
<12	70 (60.3)	46 (39.7)	0.003	2.1 (1.1-2.9)
SOFA				
0-6	24 (30)	56 (70)		1.0
>6	58 (72.5)	22 (27.5)	0.001	2.36 (1.7-3.1)
Renal Dysfunction				
No	30 (35.7)	54 (64.3)		1.0
Yes	52 (68.4)	24 (31.6)	0.001	1.81 (1.3-2.2)
ARDS				
No	54 (45 %)	66 (55%)		1

Yes	28 (70%)	12 (30%)	0.016	1.59 (1.1-1.9)
SEPSIS				
Sepsis	46 (44.2)	58 (55.8)	0.075	-
Septic shock	36 (64.3)	20 (35.7)	0.07	1.5 (0.9-2.1)

n—number of patients; SOFA—sequential organ failure assessment; ARDS—acute respiratory distress syndrome; (%)—percentage given in parenthesis

All the parameters which were significantly different between survivors and non-survivors were further tested with univariate and multivariate regression models. The odds ratio obtained after regression models were converted to relative risks to determine the predictors of mortality. It was observed that the risk of death was 1.7 times higher in females compared with males. Similarly, age was also strong predictor of death; the risk of dying was doubled (relative risk of 2.14) in patients who were above 60 years of age as compared with patients who were below 30 years of age. The presence of anemia was associated with almost twice the higher chance of dying as compared to those in whom anemia was not present. The risk of death was 2.1 times higher when hemoglobin level was less than 12.0 gm/dL as compared with those in whom hemoglobin level was more than 12.0 gm/dL. The renal dysfunction was also associated with higher probability of death. The risk of mortality was 1.8 times higher in patients with renal dysfunction. ARDS was associated with 1.59 times higher risk of dying as compared with those patients in whom ARDS was not present at the time of admission. Patients who presented with septic shock were having 1.5 times the risk of dying (relative risk of 1.5) as compared with those patients who had features of sepsis only. The SOFA score more than 6 at the day 1 of admission were associated with more than double the risk of death. The relative risk of death in SOFA > 6 was 2.36. Among these, the variables which were associated with higher risk of death, after multivariate regression analysis were the presence of anemia and SOFA score more than 6.

Discussion

Sepsis is a consequence of clinical illness of infection and systemic inflammatory response. It occurs as a result of organ dysfunction (severe sepsis) with shock (septic shock). Although introducing septic shock assent requires, frank hypotension, however, some have argued that evidence of hypoperfusion such as elevated levels of lactate in the blood >=4mmolll. In the United States, more than 750,000 people develop severe sepsis each year when close to 30 per cent die in the infirmary. Ideally, about 2/100 of hospitalized patients having severe sepsis and only 10% of patients in the group intensive care unit (ICU) have severe sepsis on admission or through staying in ICU. The Sepsis Occurrence in Acutely Ill Patients (SOAP) study across Europe recorded that greater than 35% of ICU patients got sepsis at several points through ICU stay, with a death rate of 27%. Almost all microbes lead to sepsis in compromised immune patients. In increment to the frequent pathogens, sepsis can as well evolve secondary to opportunistic microorganisms in low immune patients. The utmost kind of infection is pneumonia that leads to severe sepsis (44%), followed by primary bacteremia (17%), infection of the genital tract (9%), infection of abdominal (9%), and, minimum ordinary, infections of soft tissue and wound infections (7%). About 1/3 of the sepsis patients have a negative culture study. Bacteria are the dominant cause of severe sepsis. The clever doctor discovered that sepsis's early manifestation could be superficial and nonspecific, such as unexplained tachypnea, changes of intellectual condition hyperglycemia, and diaphoresis. As well as significant to identify old age and suppressed immune patients with sepsis often do not own increase WBC count or fever. In that individual, hypothermia should specifically seek for, and if found, managed critically, other laboratory and physical feedback rapid an expert physician to deduce that an infected patient 'looks septic', setting the kind of implied infection and the existence of organ dysfunction. The predisposing situations like elderly, organ transplantation history, immunocompromised, trauma, diabetes mellitus and surgery quickly ascertained. Vital signs need careful observation. Though numerous patients with sepsis will be feverish, up to 1/2 of the septic patients can be hypothermic or norm thermic. Increasing heart rate is a common sign as increase respiratory rate, and pulmonary condition needs careful observation for respiratory failure evidence. A meticulous checking could lead your quick guide on the likely infection source and the patient's common clinical conditions. Patients with sepsis evidence should have blood aspirated for basic laboratory investigations, including CBC, the whole metabolic panel, and hemostasis study. White blood cell count, metabolic acidosis, hepatic or renal dysfunction should seek. Also, lactate blood level gain in the septic patient with an increased level considering a guide for sepsis-related organ hypoperfusion. It is also beneficial to view the kidney tissue and the collecting system in the septic patient with suspected perinephric abscess and exclude an obstructive uproar they significantly; bedside ultrasonography may help other diagnostic aims such as evaluating a patient's intravascular volume status. Computed tomography (CT) is more useful. Multiple biomarkers are estimated for use in sepsis. Most are estimated as prognostic markers in sepsis; others for

diagnosis so far, neither found enough specificity or sensitivity to be systematically used. Procalcitonin has been the utmost vastly studied, but has recognized false positives (e.g. Burns, severe injuries and shocks) and false negatives (early infection, localized abscesses). As a prognostic marker, procalcitonin levels have shown to correlate with death.

In this prospective observational ICU-based study, we assessed the predictors of mortality and morbidity of patients admitted with sepsis and septic shock in a surgical ICU. A total of 160 cases were included in this study, which included 86 males and 74 females, with male: female ratio of 1.16 :1.

A higher heart rate (105.1 ± 13.5) and lower mean arterial pressure (85.4 ± 19.8) at the time of admission to the ICU could be predictors of mortality of severely septic patients admitted to the ICU though these observations were of borderline statistical significance in present study.

A number of studies have found that serum lactate concentrations are a predictor of mortality [15], and several treatment methods for sepsis are dependent on lactate concentrations [16]. Additionally, in this investigation, individuals who passed away from severe sepsis had greater blood lactate levels. The mean serum creatinine levels between survivors and non-survivors did not differ significantly. Acute renal failure was not identified to be a major independent risk factor for death in patients with severe sepsis or septic shock in a study by Oppert et al. [17].

The mean haemoglobin level was substantially lower in non-survivors (9.7 g/dL) compared to survivors (11.2 g/dL), and patients with haemoglobin levels below 12.0 g/dL had a 2.1 times greater chance of passing away than those with levels above this level. 25% of our patients had ARDS, a severe sepsis complication that is linked to a greater mortality risk. In several trials, ARDS rates ranged considerably from 28% to up to 59%, increasing the need for mechanical ventilation and its attendant problems. Acute kidney damage (AKI) affects 1%–25% of patients in intensive care units and results in death rates of 15%–60%. [19-21]. 47.5% of our patients had renal impairment, and 68.4% of them died. The factors contributing to this greater incidence of kidney-related bad outcomes may include direct infectious disease-related kidney damage as well as hypoxia damage brought on by the high prevalence of patients with septic shock.

Presence of higher SOFA baseline scores were independent predictors of increased mortality. The SOFA scores at admission were high among non-survivors (8.2 ± 2.5). There was a significant difference of the First SOFA values among the non-survivors and survivors of severe sepsis, which were 8.2 (SD± 2.5) and 4.9 (SD± 2.1), respectively. This difference was statistically significant. Similar investigations had found that SOFA ratings, both at the time of presentation and 48 hours later in ICU patients, were crucial indicators of death [22]. The risk of mortality was more than doubled for SOFA scores more than 6 on the first day of admission. In SOFA > 6, the relative risk of mortality was 2.36. Therefore, SOFA scoring should be performed on the day of arrival to identify patients with severe sepsis who are more likely to die within a short period of time. This will allow for the planning of effective therapies to change the outcome.

We identified multiple risk factors for predictors of mortality on Univariate analysis, but multivariate analysis identified presence of anemia and SOFA scores of greater than 6 as risk factors for mortality in severe sepsis/septic shock.

Conclusion

In conclusion, incidence of severe sepsis was high among ICU admissions, and they have a high mortality. Higher SOFA scores at admission were associated with higher mortality in severe sepsis/septic shock.

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