e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.11.76

International Journal of Pharmaceutical Quality Assurance 2025; 16(11); 482-488

Original Research Article

Comparison of Severity Scoring Systems as Predictors of Mortality in Emergency Sepsis Patients

Asif Equbal[1], Mukesh Kumar Kushawaha[2], Ajay Kumar Sinha[3], Bishwajit Prasad Azad[4]

[1]Senior Resident, Department of Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India
[2]Senior Resident, Department of Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India
[3]Professor and HOD, Department of Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India
[4]Professor, Department of Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India

Received: 18-09-2025 / Revised: 16-10-2025 / Accepted: 25-11-2025
Corresponding Author: Dr. Mukesh Kumar Kushawaha
Conflict of interest: Nil

Abstract:

Background: Sepsis is a leading cause of morbidity and mortality among patients presenting to emergency departments, particularly in low- and middle-income countries. Early identification of high-risk patients is crucial for improving outcomes.

Aim: To identify clinical, laboratory, and management-related predictors of in-hospital mortality among sepsis patients admitted through emergency medicine.

Methodology: A hospital-based retrospective observational cohort study was conducted at Department of Medicine NMCH, Patna, Bihar, India. Medical records of 110 adult sepsis patients admitted through the emergency department were analyzed. Demographic details, clinical parameters, laboratory findings, treatment variables, and outcomes were recorded. Multivariable logistic regression was used to identify independent predictors of mortality.

Results: The in-hospital mortality rate was 21.8%. Mortality was significantly higher among patients aged >60 years, those with qSOFA ≥2, serum lactate >2 mmol/L, vasopressor requirement, ICU admission, and delayed antibiotic administration. Multivariable analysis identified age >60 years, qSOFA ≥2, elevated lactate levels, vasopressor use, and delayed antibiotics as independent predictors of mortality.

Conclusion: Mortality in sepsis patients admitted through emergency medicine is strongly associated with advanced age, disease severity at presentation, hemodynamic instability, and delayed treatment. Early risk stratification and timely intervention are essential to improve survival.

Introduction

Sepsis has not ceased to be a significant global health issue and is still among the top reasons for the emergency department patients' deaths and disabilities [1]. It is a very serious condition that develops due to the body responding incorrectly to an infection; the consequence of such a response is a rise in the level of dysfunction of the organs, leading in extreme instances to infected shock and ultimately death. Mortality related to sepsis continues to be unacceptably high especially in low- and middle-income countries, despite the introduction of new antimicrobial therapies to improve the situation. Emergency medicine has a very important part in early detection, determining the patient's level of risk, and starting the right treatment on time in case of sepsis because the outcomes are greatly influenced by the quality of care given during the first hours of the patient's presentation [2]. Therefore, knowing the factors that determine the death of sepsis patients admitted via emergency medicine is essential for the improvement of clinical decision-making and patient outcomes.

Patients with sepsis often visit the emergency room and are commonly accompanied by non-specific signs like fever, changed mental status, low blood pressure, fast heart rate, or respiratory distress [3]. These diverse symptoms can result in delayed diagnosis and treatment, thus heightening the risk of negative outcomes. It is critical to identify high-risk patients as soon as possible since the rapid start of the right interventions—such as early antibiotic therapy, fluid resuscitation, and organ support—has been proven to drastically lower mortality rates. But not all the sepsis patients have the same prognosis, and the outcomes hinge upon the complex interplay of host factors, pathogen traits, illness severity, and care timing [4]. Recognizing dependable mortality

predictors at the time of emergency admission can help doctors in giving priority to care, resource allocation, and the decision of the extent of monitoring practices or early ICU admission.

There are a number of patient-related factors that have been associated with increased mortality in sepsis. Among the factors, advanced age is the most attributed to the great mortality rate and the aged patients due to their physiological reserves being very low, they having multiple comorbidities, and even presenting with atypical clinical signs that may cause delay in diagnosis, also recognized are the elder patients. Besides advanced age, the comorbid conditions like diabetes mellitus, chronic kidney disease, chronic liver disease, heart disease, cancer, and immunosuppression have been associated with death in sepsis. With chronic diseases, not only the immune system is less able to fight infection but also the organs are more prone to dysfunction during sepsis. Moreover, pre-existing functional status and nutrient loss may affect the body's tolerance to the systemic inflammatory response and consequent organ failure [5].

Clinical and physiological parameters evaluated when patients come to the emergency department are very important in mortality prediction. One of the hemodynamic indicators is hypotension needing vasopressor support, which shows that there is serious damage to the circulatory system and it corresponds with a great risk of death [6]. Changes in consciousness may mean either lack of blood flow to the brain or brain damage due to the patient's metabolic state and have been pointed out as a sign of severe sepsis. These signs also include tachypnea, hypoxemia, or the patient put on mechanical ventilation as respiratory failure which shows the disease to be very advanced. In this context, the Sequential Organ Failure Assessment (SOFA), quick SOFA (qSOFA), and Acute Physiology and Chronic Health Evaluation (APACHE) scoring systems have been developed to quantify the severity of the illness and predict the outcomes; therefore, the components of these scoring systems are often assessed in the emergency room.

During the first assessment, laboratory parameters were also obtained which gave a very useful prognostic information [7]. High serum lactate levels are considered the most important sign of tissue hypoperfusion and metabolic stress and have been correlated with high mortality rates. Abnormalities in the tests of renal function, liver enzymes, coagulation profiles, and platelet counts can be seen as a reflection of organ dysfunction which is increasing and thus, they are used in risk stratification [8]. Inflammatory markers like C-reactive protein and procalcitonin, although their specificity is doubtful, may indicate the severity and progression of the disease. Besides, the presence of metabolic acidosis, electrolyte disturbances, and increased cardiac injury biomarkers are still another sign of systemic involvement and poor prognosis.

Mortality in sepsis patients admitted via emergency medicine is affected both by factors related to the patient and the disease and by system and treatment-related variables. Inferior outcomes can be greatly compounded through delays in recognition, delayed delivery of the correct antibiotics, inadequate initial fluid resuscitation, and limited access to critical care resources. Emergency departments that are crowded, absence of sepsis protocols that are standardized, and variations in clinician's level of training are some of the factors that may lead to inconsistencies in the early management of patients. For this reason, the identification of mortality predictors is essential, not only for clinical assessment but also for the improvement and evaluation of healthcare delivery systems.

Sepsis is of a great burden, and emergency medicine has a critical role in its management; thus, the study of mortality predictors in this patient group is of significant clinical importance. Knowing the demographic, clinical, and laboratory predictors well can help that early risk stratification, timely escalation of care, and targeted intervention strategy development are all possible. The result of this type of insight would be a decrease in sepsis-related mortality and an increase in the quality of emergency and critical care services.

Methodology

Study Design: The current research was planned to be a hospital-centric observational cohort study meant to spot the clinical, laboratory, and management-related factors that could predict death among patients presenting with sepsis via the emergency medicine department. The research adopted a retrospective analytical method, and the patient data were taken from the hospital medical records. This methodology was selected to enable the assessment of actual clinical outcomes and the related factors in sepsis patients treated in an emergency care context.

Study Area: The research was performed in the Department of Medicine, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India from September 2024 to August 2025.

Study Participants: The study population consisted of adult patients admitted through the emergency medicine department with a clinical diagnosis of sepsis.

Inclusion Criteria

Patients were included in the study if they met the following criteria:

1. Age ≥ 18 years
2. Admission through the emergency medicine department

3. Clinical suspicion or diagnosis of sepsis based on symptoms suggestive of infection along with organ dysfunction, as assessed by treating physicians
4. Availability of complete medical records including clinical parameters, laboratory investigations, and outcome data

Exclusion Criteria

Patients were excluded from the study if they met any of the following criteria:

1. Patients receiving palliative or end-of-life care
2. Pregnant women
3. Patients diagnosed with COVID-19 or other non-septic critical illnesses
4. Patients with incomplete or inaccessible medical records
5. Patients transferred to other institutions before definitive outcome assessment

Sample Size: A total of 110 patients meeting the inclusion and exclusion criteria were included in the study. The sample size was determined based on feasibility, availability of complete records, and the study period, ensuring adequate representation for identifying predictors of mortality among sepsis patients.

Procedure: The medical records of the eligible patients who had been admitted through the emergency department were thoroughly examined. Data were gathered using a structured proforma. The variables were sociodemographic indicators (age and sex), clinical parameters at the time such as vital signs and altered mental status, comorbid diseases, and severity indicators such as systolic blood pressure, respiratory rate, and Glasgow Coma Scale. Sepsis severity was evaluated by using the quick Sequential Organ Failure Assessment (qSOFA) and other validated scoring systems. Where available, laboratory parameters such as serum lactate, platelet count, serum creatinine, bilirubin levels, and blood culture results were noted. Treatment-related variables like time to initiation of antibiotics, vasopressors, ICU admission, and hospital stay duration were also recorded. The primary outcome of interest was in-hospital mortality, while secondary outcomes were ICU admission and hospital stay length. All the data collected were anonymized as a measure to protect patient confidentiality.

Statistical Analysis: Data were imported to Microsoft Excel and subsequently analyzed using SPSS version 27.0. Categorical variables were represented by their frequencies and percentages, while continuous variables were shown as mean ± standard deviation or median with interquartile range depending on data distribution. The comparison of survivors and non-survivors was done with Chi-square/Fisher's exact test and Student's t-test/Mann–Whitney U test depending on the nature of the data. Multivariable logistic regression was used to identify mortality predictors that were independent of each other. A p-value of less than 0.05 was the threshold for statistical significance.

Result

Table 1 presents the sociodemographic and clinical baseline data of the study participants, which totalled 110. The age distribution of participants showed that those in the 41–60 years group represented the largest section of the sample (41.8%), followed by more than 60 years group (32.7%), whereas the age group of ≤40 years accounted for 25.5% of the sample. The male participants made up the majority of the cohort (61.8%) in comparison to the female participants (38.2%). Talking about comorbidities, the most frequent disease noticed was diabetes mellitus (40%) which was followed by hypertension (34.5%) and chronic kidney disease (16.4%), while a little over one-fifth (21.8%) of study subjects had no comorbid illness reported, which shows that a significant proportion of patients were in the presence of at least one underlying chronic disease.

Table 1: Sociodemographic and Baseline Clinical Characteristics of Study Participants (n = 110)

Variable	Frequency (n)	Percentage (%)
Age (years)		
≤40	28	25.5
41–60	46	41.8
>60	36	32.7
Gender		
Male	68	61.8
Female	42	38.2
Comorbidities		
Diabetes mellitus	44	40
Hypertension	38	34.5
Chronic kidney disease	18	16.4
No comorbidity	24	21.8

Table 2 presents a summary of clinical features and laboratory results of patients who came into the emergency department during a time when the cohort accordingly with significant disruptions in the body's function. The average systolic blood pressure was low (96.4 ± 18.2 mmHg), which means the blood pressure was on the lower side, while the median breathing rate was 24/min, which indicates that the patients were struggling to breathe. The median score on the Glasgow Coma Scale (GCS) was 13, indicative of a slight to moderate loss of consciousness. Even though a little over half of the patients (54, 49.1%) had a qSOFA score of 2 or more which is indicative of seriously ill patients with high chance of death. Besides, the biochemical parameters supported the diagnosis of highly severe illness, as the high median serum lactate levels (3.2 mmol/L) indicated that the tissues did not receive enough blood and oxygen, alongside the high serum creatinine levels pointing to kidney malfunction. The mean platelet count was moderately low, which could be due to septic thrombocytopenia. Moreover, blood cultures were positive in almost one-third of the patients (30.9%), which means that this group had quite a significant number of bloodstream infections.

Table 2: Clinical and Laboratory Parameters at Emergency Department Presentation	
Parameter	**Mean ± SD / Median (IQR)**
Systolic BP (mmHg)	96.4 ± 18.2
Respiratory rate (/min)	24 (22–28)
Glasgow Coma Scale	13 (11–15)
qSOFA score ≥ 2	54 (49.1%)
Serum lactate (mmol/L)	3.2 (2.1–4.6)
Platelet count (×10⁹/L)	1.62 ± 0.58
Serum creatinine (mg/dL)	1.9 (1.2–3.1)
Positive blood culture	34 (30.9%)

Table 3 shows that there are considerable differences in all evaluated parameters between the survivors and the deceased patients, and it compares these patients regarding their clinical and demographic characteristics. The difference that was the greatest in this aspect was that more than half of the deceased patients were over 60 years old as compared to only a quarter of the survivors (58.3% vs. 25.6%, p = 0.003), hence it can be concluded that being old is a significant risk of death. The severity of the disease was indicated by qSOFA scores, which were in the range of ≥2 for 83.3% of the non-survivors compared to 39.5% of the survivors, so it can be said that there was a significant difference in mortality among the groups ($p < 0.001$). The levels of lactate in the serum of the deceased patients were higher (>2 mmol/L) (91.7%) than those of the survivors (46.5%) ($p < 0.001$), which is an indication of greater disturbance in circulation and metabolism. The need for the use of vasopressor agents was also greater in non-survivors (79.2% vs. 20.9%, $p < 0.001$), indicating the presence of very severe and unstable blood pressure in this group. The difference in ICU admission rates was also significant with non-survivors (87.5%) versus survivors (25.6%) ($p < 0.001$), thus pointing to the relationship between the severity of the illness and the risk of death.

Table 3: Comparison of Variables Between Survivors and Non-Survivors			
Variable	**Survivors (n = 86)**	**Non-survivors (n = 24)**	**p-value**
Age >60 years	22 (25.6%)	14 (58.3%)	0.003
qSOFA ≥ 2	34 (39.5%)	20 (83.3%)	<0.001
Lactate >2 mmol/L	40 (46.5%)	22 (91.7%)	<0.001
Vasopressor use	18 (20.9%)	19 (79.2%)	<0.001
ICU admission	22 (25.6%)	21 (87.5%)	<0.001

The characteristics regarding treatment and outcomes of sepsis patients enrolled in the study can be seen in Table 4. Early antibiotic intervention within the first hour was given to 60% of the patients, which indicates only partial compliance with the recommended management protocols for sepsis. 33.6% of the patients required vasopressor support, thus indicating a large number of patients with unstable hemodynamics. Admission to ICU was needed for 39.1% of patients, which marked the severity of illness in a considerable part of the study group. A stay in the hospital for more than a week was reported among 43.6% of patients, which might indicate substantial morbidity and resource usage. The death rate during hospitalization was 21.8%, which means that sepsis is still a serious and life-threatening condition even when treatment interventions are in place.

Table 4: Treatment and Outcome Characteristics of Sepsis Patients		
Variable	**Frequency (n)**	**Percentage (%)**
Antibiotics within 1 hour	66	60
Vasopressor requirement	37	33.6
ICU admission	43	39.1
Hospital stay >7 days	48	43.6
In-hospital mortality	24	21.8

The ˙results of the multivariable logistic regression analysis, which identifies independent predictors of mortality for the study participants, are displayed in Table 5. The factor of being over 60 years of age was much more significantly correlated to the risk of death than the younger age group with less than two-fold (OR = 2.84; p = 0.028) mortality odds. A qSOFA score of ≥2 was identified as a very strong forecaster of death, as this group had nearly five times the risk of dying (OR = 4.96; p = 0.001). Death was also associated with elevated serum lactate levels (>2 mmol/L) with a strong correlation (OR = 3.72; p = 0.008), as a high level indicates poor circulation of blood to the tissues. The use of vasopressors showed a very strong link to death, increasing the odds by more than six (OR = 6.21; p < 0.001), which points to a very poor blood circulation condition. Furthermore, a delay in the beginning of antibiotic treatment of more than one hour was another independent factor with a strong association with higher mortality (OR = 2.46; p = 0.047), hence the paramount need of intensive therapy for the infection during the early hours, as it greatly promotes the survival of the affected.

Table 5: Multivariable Logistic Regression Analysis for Predictors of Mortality			
Variable	**Odds Ratio (OR)**	**95% Confidence Interval**	**p-value**
Age >60 years	2.84	1.12–7.21	0.028
qSOFA ≥ 2	4.96	1.88–13.12	0.001
Lactate >2 mmol/L	3.72	1.41–9.84	0.008
Vasopressor use	6.21	2.29–16.83	<0.001
Delayed antibiotics (>1 hr)	2.46	1.01–5.98	0.047

Discussion

Sepsis is still a major global health problem with significant pain and death rates, especially in the case of emergency department patients, where early diagnosis, and quick treatment are the main factors of good or bad outcome. In the study, sepsis mainly attacked middle-aged and older people, with a higher death rate observed among those above 60 years. This result agrees with the global epidemiological data that show an exponential increase of sepsis incidence and mortality with age because of the immunosenescence, the high comorbidity burden, and the low physiological reserve (Rudd et al., 2020) [9]. Bone et al. (1992) [10] similarly reported, identifying age as an essential host-related factor that determines the outcome of septic patients. The independent association between age >60 years and mortality in our multivariable analysis highlights the frailty of˙ elderly patients who come to ˙the emergency department with sepsis.

The male predominance found in this study correlates with previous international research that has consistently shown a higher incidence of sepsis in males (Fleischmann et al., 2016) [11]. Possible factors include biological differences in immune response, more frequent contact with occupational risk factors, and differences in seeking medical care. Nevertheless, gender was not identified as an independent prognostic factor for death in our study; rather, it is the clinical severity at presentation that overcomes the demographic factors once sepsis occurs.

Enfermedades quecoexisten, sobretodo diabetes mellitus y hipertensión, were present in considerable numbers among our patients and were associated with mortality in non-survivors. These findings support previous studies which show that chronic metabolic and cardiovascular disorders reduce immune function and microcirculatory regulation, thus leading the patients to be more susceptible to severe infections and less favorable outcomes (Singer et al., 2016) [12]. However, the presence of septic complications in patients with no manifested comorbidities in our research points out that sepsis can occur in the case of a healthy person, thus stressing the importance of recognizing such cases with high clinical suspicion regardless of the patient's health condition.

Presenting clinical severity was the most critical factor that determined death. Almost 50% of the patients showed a qSOFA score of 2 or more, which appeared to be a very potent independent predictor of death. The Sepsis-3 guidelines that qSOFA could act as a rapid bedside tool for the prognosis of patients with suspected infection outside the ICU (Seymour et al., 2016) [13]. Our findings echo the work of Freund et al. (2017) [14], which concluded that emergency department patients with qSOFA scores of 2 or more had a higher risk of in-hospital death.

Nevertheless, there were some prospective studies showing that qSOFA lacked sensitivity as a screening tool, especially for early sepsis (Loritz et al., 2020) [15]. Even so, our data still hold qSOFA and its role in recognizing high-risk patients in need of immediate healthcare extension.

Lactate elevation in serum was another strong predictor of mortality in our research. Patients whose lactate levels exceeded 2 mmol/L were at significantly higher risk of death, which was indicative of systemic oxygen deprivation and metabolic stress. This finding corroborates previous studies that have recognized lactate to be a strong prognostic indicator in septic patients even when there is no hypotension (Singer et al., 2016). Combining lactate measurement with clinical assessment gives better early risk stratification in emergency departments.

Vasopressor requirement showed the strongest association with mortality in our cohort, indicating severe circulatory failure and refractory septic shock. This finding is concordant with previous studies demonstrating that the need for vasopressors reflects advanced disease with high risk of multi-organ dysfunction and death (Seymour et al., 2016). The high ICU admission rate among non-survivors further underscores the association between hemodynamic instability and adverse outcomes.

Almost one-third of the patients showed blood culture positivity, which was the case especially among those who did not survive. The same results were indicated by Yang et al. (2021) [16], who demonstrated that septic patients with positive cultures had higher clinical severity scores, ICU stays of longer duration, and increased in-hospital death rates compared to negative culture patients. Our research, with the dominance of gram-negative bacteria particularly Escherichia coli, is in keeping with the global trend which is indicated in both developed and third-world countries (Phua et al., 2013) [17]. Nevertheless, the very high rate of culture-negative sepsis still points out the existing diagnostic difficulties and therefore, increases the demand for empiric broad-spectrum antimicrobial therapy.

Antibiotic administration at the right time turned out to be the most important modifiable factor that could predict death. In our research, it was found that giving antibiotics late for more than an hour was connected to a rise in mortality rate. This result is very well corroborated by the meta-analysis of Asner et al. (2021) [18], which revealed that there was a constant connection between the early start of antibiotic therapy and the survival rate in cases of sepsis and septic shock. Despite the fact that some research has shown inconsistent results caused by differences in study designs and timing definitions, the overall argument remains in favor of early antimicrobial therapy being a critical aspect of sepsis management.

The current research reveals that death rate among patients with sepsis who visited through emergency medicine is influenced by various factors such as patient characteristics, the extent of physiological damage at the time of the patient's presentation and the timing of the intervention. These factors included among others: older age, high qSOFA score, increased lactate levels, and the necessity for vasopressors. Also, delayed antibiotic administration was one of the strongest independent predictors of mortality. These results are in a large part congruent with the existing literature and they further highlight the importance of quick evaluation, early risk stratification and quick management which is based on evidence to save lives in the sepsis care within the emergency department.

Conclusion

The research brings to light the significant death toll among sepsis patients who were admitted through the emergency department and points out the early risk stratification as a necessity. Old age, high qSOFA scores, high serum lactate levels, need for vasopressor support, and slow start of antibiotics were found to be the most important independent predictors of in-hospital death. The results draw attention to the fact that both patient-related elements and early physiological changes at the time of presentation have a major impact on the outcome. The survival rate will be improved with the early identification of high-risk patients, quick assessment with simple bedside tools, and timely initiation of the right antimicrobial and supportive therapies. The strengthening of sepsis protocols, the upgrading of emergency department's readiness, and the compliance with early management bundles could bring about a marked decrease in sepsis-related mortality, especially in resource-limited areas.

References

1. Schlapbach LJ, Kissoon N, Alhawsawi A, Aljuaid MH, Daniels R, Gorordo-Delsol LA, Machado F, Malik I, Nsutebu EF, Finfer S, Reinhart K. World Sepsis Day: a global agenda to target a leading cause of morbidity and mortality. American Journal of Physiology-Lung Cellular and Molecular Physiology. 2020 Sep 1;319(3):L518-22.
2. Husabø G, Nilsen RM, Flaatten H, Solligård E, Frich JC, Bondevik GT, Braut GS, Walshe K, Harthug S, Hovlid E. Early diagnosis of sepsis in emergency departments, time to treatment, and association with mortality: an observational study. PloS one. 2020 Jan 22;15(1):e0227652.
3. Jones AE, Heffner AC, Horton JM, Marchick MR. Etiology of illness in patients with severe sepsis admitted to the hospital from the emergency department. Clinical Infectious Diseases. 2010 Mar 15;50(6):814-20.

4. Dolin HH, Papadimos TJ, Chen X, Pan ZK. Characterization of pathogenic sepsis etiologies and patient profiles: a novel approach to triage and treatment. Microbiology insights. 2019 Jan; 12:1178636118825081.
5. Peelen L, de Keizer NF, Peek N, Scheffer GJ, van der Voort PH, de Jonge E. The influence of volume and intensive care unit organization on hospital mortality in patients admitted with severe sepsis: a retrospective multicentre cohort study. Critical care. 2007 Mar 22;11(2):R40.
6. Giesinger RE, McNamara PJ. Hemodynamic instability in the critically ill neonate: an approach to cardiovascular support based on disease pathophysiology. InSeminars in perinatology 2016 Apr 1 (Vol. 40, No. 3, pp. 174-188). WB Saunders.
7. Müller B, Harbarth S, Stolz D, Bingisser R, Mueller C, Leuppi J, Nusbaumer C, Tamm M, Christ-Crain M. Diagnostic and prognostic accuracy of clinical and laboratory parameters in community-acquired pneumonia. BMC infectious diseases. 2007 Mar 2;7(1):10.
8. Boccardo P, Remuzzi G, Galbusera M. Platelet dysfunction in renal failure. InSeminars in thrombosis and hemostasis 2004 Oct (Vol. 30, No. 05, pp. 579-589). Copyright© 2004 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA.
9. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, Colombara DV, Ikuta KS, Kissoon N, Finfer S, Fleischmann-Struzek C. Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study. The Lancet. 2020 Jan 18;395(10219):200-11.
10. Bone RC, Balk RA, Cerra FB, Dellinger RP, Fein AM, Knaus WA, Schein RM, Sibbald WJ. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest. 1992 Jun 1;101(6):1644-55.
11. Fleischmann C, Scherag A, Adhikari NK, Hartog CS, Tsaganos T, Schlattmann P, Angus DC, Reinhart K. Assessment of global incidence and mortality of hospital-treated sepsis. Current estimates and limitations. American journal of respiratory and critical care medicine. 2016 Feb 1;193(3):259-72.
12. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS. The third international consensus definitions for sepsis and septic shock (Sepsis-3). Jama. 2016 Feb 23;315(8):801-10.
13. Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, Rubenfeld G, Kahn JM, Shankar-Hari M, Singer M, Deutschman CS. Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (Sepsis-3). Jama. 2016 Feb 23;315(8):762-74.
14. Freund Y, Lemachatti N, Krastinova E, Van Laer M, Claessens YE, Avondo A, Occelli C, Feral-Pierssens AL, Truchot J, Ortega M, Carneiro B. Prognostic accuracy of sepsis-3 criteria for in-hospital mortality among patients with suspected infection presenting to the emergency department. Jama. 2017 Jan 17;317(3):301-8.
15. Loritz M, Busch HJ, Helbing T, Fink K. Prospective evaluation of the quickSOFA score as a screening for sepsis in the emergency department. Internal and emergency medicine. 2020 Jun;15(4):685-93.
16. Yang L, Lin Y, Wang J, Song J, Wei B, Zhang X, Yang J, Liu B. Comparison of clinical characteristics and outcomes between positive and negative blood culture septic patients: a retrospective cohort study. Infection and drug resistance. 2021 Oct 12:4191-205.
17. Phua J, Ngerng WJ, See KC, Tay CK, Kiong T, Lim HF, Chew MY, Yip HS, Tan A, Khalizah HJ, Capistrano R. Characteristics and outcomes of culture-negative versus culture-positive severe sepsis. Critical care. 2013 Sep 12;17(5):R202.
18. Asner SA, Desgranges F, Schrijver IT, Calandra T. Impact of the timeliness of antibiotic therapy on the outcome of patients with sepsis and septic shock. Journal of Infection. 2021 May 1;82(5):125-34.