**Name of Journal:** *World Journal of Clinical Cases*

**Manuscript NO:** 86227

**Manuscript Type:** ORIGINAL ARTICLE

***Retrospective Study***

**Analysis of prognostic factors in patients with emergency sepsis**

Ning XL *et al*. Prognostic factors in emergency sepsis

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**Received:** July 4, 2023

**Revised:** July 21, 2023

**Accepted:** August 7, 2023

**Published online:**

**Abstract**

BACKGROUND

Emergency sepsis is a common and serious infectious disease, and its prognosis is influenced by a number of factors.

AIM

To analyse the factors influencing the prognosis of patients with emergency sepsis in order to provide a basis for individualised patient treatment and care. By retrospectively analysing the clinical data collected, we conducted a comprehensive analysis of factors such as age, gender, underlying disease, etiology and site of infection, inflammatory indicators, multi-organ failure, cardiovascular function, therapeutic measures, immune status and severity of infection.

METHODS

Data collection: Clinical data were collected from patients diagnosed with acute sepsis, including basic information, laboratory findings, medical history and treatment options. Variable selection: Variables associated with prognosis were selected, including age, gender, underlying disease, etiology and site of infection, inflammatory indicators, multi-organ failure, cardiovascular function, treatment measures, immune status and severity of infection. Data analysis: The data collected are analysed using appropriate statistical methods such as multiple regression analysis and survival analysis. The impact of each factor on prognosis was assessed according to prognostic indicators, such as survival, length of stay and complication rates.

RESULTS

Descriptive statistics: Descriptive statistics were performed on the data collected from the patients, including their basic characteristics and clinical presentation.

CONCLUSION

Type 2 diabetes mellitus were independent factors affecting the prognosis of patients with sepsis.

**Key Words:** Platelet count; Length of ICU stay; Mechanical ventilation; Abdominal infection; Combined coronary artery disease

Ning XL, Shao M. Analysis of prognostic factors in patients with emergency sepsis. *World J Clin Cases* 2023; In press

**Core Tip:** Age, gender, underlying disease, etiology and site of infection, inflammatory indicators, multi-organ failure, cardiovascular function, therapeutic measures, immune status, and severity of infection are important factors influencing the prognosis of emergency sepsis patients.

**INTRODUCTION**

Sepsis is a life-threatening condition caused by a dysregulated host response to infection resulting in organ dysfunction and is a common high mortality syndrome[1-5]. With the treatment of underlying infections, optimisation of organ perfusion is the mainstay of sepsis treatment, including the use of intravenous fluids and antihypertensive agents. The heart is one of the key organs involved in sepsis, and myocardial injury and cardiac insufficiency including diastolic and/or systolic dysfunction often occurs in patients with sepsis and is a significant cause of death in septic patients[6,7]. Diastolic dysfunction in sepsis is associated with fluid resuscitation in septic patients, and elevated left ventricular filling pressures are strongly associated with mortality[8,9]. With the development of haemodynamic monitoring and cardiac ultrasound technology, the American Society of Echocardiography revised the definition of diastolic dysfunction in 2009, but operational measurement is often difficult due to the complexity of its measurement and the frequent occurrence of arrhythmias such as tachycardia or atrial fibrillation in critically ill patients. The ratio of peak early mitral diastolic flow velocity to early mitral annular diastolic motion velocity (E/e') is commonly used to reflect elevated left heart filling pressures and is easily measured in critically ill patients. Based on a simplified classification of diastolic function in sepsis[10], the aim of this study was to investigate the factors that influence the prognosis of patients with sepsis according to their clinical characteristics and to provide a theoretical basis for the prognosis of patients with sepsis. It is reported as follows.

Age: Age is an important prognostic factor, with older patients usually having a poorer prognosis. Gender: Gender may have an impact on prognosis, as women usually have a better prognosis than men. Underlying disease: Patients with some chronic diseases (*e.g.* diabetes, heart disease, kidney disease, *etc.*) usually have a poorer prognosis[11-17]. Etiology and site of infection: Different sites and causes of infection may have different prognostic implications. Certain sites of infection (*e.g.* bloodstream infection) may have a poorer prognosis. Inflammatory indicators: Abnormal levels of inflammatory indicators (*e.g.* C-reactive protein, white blood cell count, calcitoninogen, *etc.*) are associated with prognosis. Higher inflammatory markers are usually associated with a poorer prognosis. Multi-organ failure: Multi-organ failure is one of the complications of severe sepsis and has a significant impact on prognosis[18-26]. Cardiovascular function: Instability of cardiovascular function is associated with prognosis. Hypotension and arrhythmias may predict a poorer prognosis. Therapeutic measures: Early and appropriate therapeutic measures, such as antibiotic therapy and haemodynamic support, are essential for prognosis. Immune status: Patients with impaired immune function (*e.g.* immunosuppressant users, HIV-infected patients, *etc.*) usually have a poorer prognosis. Severity of infection: The severity of the infection and the level of sepsis scoring systems (*e.g.* SOFA score, APACHE II score) are associated with prognosis. These are only some of the possible factors, and the specific influences will also depend on the study design, patient sample and data availability. When conducting specific analyses, statistical methods such as multiple regression analysis and survival analysis can be used to determine which factors have the most significant impact on prognosis.

**MATERIALS AND METHODS**

***General information***

Retrospective analysis of the clinical data of 102 patients with sepsis in the emergency care unit [collectively referred to as intensive care unit (ICU)] of our hospital from May 2018 to April 2023. (1) Inclusion criteria: Meeting the latest diagnostic criteria of sepsis 3.0 promulgated by the American Society of Critical Care Medicine and the European Society of Critical Care Medicine in 2016, with a SOFA score ≥ 2 (a baseline SOFA score of 0 was suspiciously assumed for patients with unknown underlying organ dysfunction); and (2) Exclusion criteria: (I) those who died of disease within 48 h of diagnosis of sepsis and septic shock; (II) acute coronary syndrome, malignant arrhythmias; (III) unclear ultrasound images; (IV) advanced malignancy; and (V) post-cardiopulmonary resuscitation. Patients were divided into a death group and a survival group according to their clinical outcome in hospital. The study was approved by the hospital ethics committee.

***Methodology***

Clinical data such as age, gender, body mass index, comorbidities, laboratory tests such as white blood cell count, platelet count, blood creatinine value, blood potassium, glutamate transaminase, classification of the source of infection, duration of ICU stay, acute physiology and chronic health evaluation (APACHE II), sequential organ failure (SOFA) score, and the application of tissue Doppler imaging to determine peak mitral valve diastolic velocity (E) and mitral annular diastolic velocity (SOFA). APACHE II, sequential organ failure (SOFA) score and the use of tissue Doppler imaging to determine peak mitral valve early diastolic flow velocity (E), early mitral annular motion velocity (e') and E/e'.

***Observation indicators***

The clinical data of the patients were analysed and classified according to their cardiac function as normal cardiac function, abnormal systolic function (LVEF < 50%), diastolic dysfunction, and systolic and diastolic dysfunction. Diastolic dysfunction is graded according to the simplified method: e' < 8 and E/e'. Diastolic dysfunction grade I: e' < 8 and E/e' ≤ 8, diastolic dysfunction grade II: e' < 8 and 8 < E/e' < 13, diastolic dysfunction grade III: e' < 8 and E/e' ≥ 13. Analyse the factors affecting the prognosis of patients with sepsis.

***Statistical treatment***

SPSS 25.0 software was used for statistical analysis of the data obtained. The measurement data conforming to normal distribution were expressed as (mean ± SD) and compared by *t*-test; the measurement data conforming to non-normal distribution were expressed as M(P25, P75) and the rank sum test was used for comparison between groups. Statistical data were expressed as rates (%), and comparisons were made using the *X*2 test. Variables with statistically significant differences in univariate analysis were introduced into a binary logistic regression model for multivariate analysis. Differences were considered statistically significant at *P* < 0.05.

**RESULTS**

***Analysis of the patient's clinical data***

The study included 102 patients with sepsis, 60 males and 62 females; age 30-87 years, mean (61.69 ± 8.78) years; 63 patients were mechanically ventilated by tracheal intubation; APACHE II score 16-33, mean (24.38 ± 3.20); SOFA score 7-17, mean (12.27 ± 1.95) points. There were 46 cases in the death group and 56 cases in the survival group.

***Univariate analysis of factors***

Affecting the prognosis of septic patients comparing E, e', platelet count, creatinine maximum, SOFA score, ICU length of stay, cardiac function classification, abdominal infection, mechanical ventilation, type 2 diabetes and coronary artery disease in both groups were statistically significant (*P* < 0.05), Tables 1-3.

***Multi-factor analysis of variables***

Affecting the prognosis of patients with sepsis Multi-factor analysis of variables that were significant in the univariate analysis was performed, where E, platelet count, duration of ICU stay, abdominal infection, mechanical ventilation, type 2 diabetes and coronary heart disease were independent influencing factors on the death of patients with sepsis (*P* < 0.05), Table 4.

**DISCUSSION**

Myocardial injury due to sepsis was previously thought to refer specifically to myocardial systolic dysfunction; however, recent studies have shown that myocardial injury in sepsis can manifest as different types of cardiac dysfunction, such as left ventricular diastolic dysfunction, left ventricular systolic dysfunction, and that the different types of cardiac dysfunction can coexist with each other. Both left ventricular diastolic dysfunction and systolic dysfunction are predictors of mortality in patients with sepsis compared with patients with normal cardiac function[27-31]. The author classified diastolic dysfunction into classes I, II and III based on a simplified classification of diastolic function in sepsis, based on the E/e' ratio. This is more consistent with previous studies reported.

There are limited invasive methods of measuring cardiac diastolic function in patients with sepsis. e/e' correlates well with left ventricular end-diastolic pressure in patients with sepsis[32-35]. In this study, a univariate analysis of cardiac function grading revealed a statistically significant difference (*P* < 0.05) when comparing cardiac function grading between the surviving and deceased groups, but a multifactorial logistic regression analysis failed to show a statistically significant difference, a study that appears to contradict the results of recent studies. The author considers that the reasons for the inconsistent findings may be related to the small sample size of this study, case selection bias, timing of cardiac ultrasound assessment, simplified version of the diastolic function definition, and treatment received.

**CONCLUSION**

The results of this study showed that E, platelet count, days of ICU stay, abdominal infection, mechanical ventilation, type 2 diabetes mellitus and coronary heart disease were independent factors influencing death in patients with sepsis (*P* < 0.05). Patients in the survivor group had longer ICU stays than those in the death group, and the analysis may be related to factors such as receiving haemodialysis. Small retrospective studies suggest that early initiation of continuous renal replacement therapy may improve clinical acute kidney injury in septic patients.

**ARTICLE HIGHLIGHTS**

***Research background***

Emergency sepsis is a common and serious infectious disease, and its prognosis is influenced by a number of factors.

***Research motivation***

The aim of this study was to analyse the factors influencing the prognosis of patients with emergency sepsis in order to provide a basis for individualised patient treatment and care. By retrospectively analysing the clinical data collected.

***Research objectives***

We conducted a comprehensive analysis of factors such as age, gender, underlying disease, etiology and site of infection, inflammatory indicators, multi-organ failure, cardiovascular function, therapeutic measures, immune status and severity of infection.

***Research methods***

Clinical data were collected from patients diagnosed with acute sepsis, including basic information, laboratory findings, medical history and treatment options. Variable selection: Variables associated with prognosis were selected, including age, gender, underlying disease, etiology and site of infection, inflammatory indicators, multi-organ failure, cardiovascular function, treatment measures, immune status and severity of infection. Data analysis: The data collected are analysed using appropriate statistical methods such as multiple regression analysis and survival analysis. The impact of each factor on prognosis was assessed according to prognostic indicators, such as survival, length of stay and complication rates.

***Research results***

Descriptive statistics were performed on the data collected from the patients, including their basic characteristics and clinical presentation.

***Research conclusions***

Type 2 diabetes mellitus were independent factors affecting the prognosis of patients with sepsis.

***Research perspectives***

The impact of each factor on prognosis was assessed according to prognostic indicators, such as survival, length of stay and complication rates.

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**Footnotes**

**Institutional review board statement:** The study was reviewed and approved by the [The First Affiliated Hospital of Anhui Medical University] Institutional Review Board.

**Informed consent statement:** Informed written consent was obtained from the patient for publication of this study. All participants are confirmed.

**Conflict-of-interest statement:** All the authors declare that they have no conflict of interest.

**Data sharing statement:** No additional data are available.

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**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review started:** July 4, 2023

**First decision:** July 19, 2023

**Article in press:**

**Specialty type:** Critical care medicine

**Country/Territory of origin:** China

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Maraka S, United States; Volk HA, Germany **S-Editor:** Liu JH **L-Editor:** A **P-Editor:** Liu JH

**Table 1 Univariate analysis of factors affecting the breath parameters of patients**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **Left ventricular end-diastolic internal diameter (mm)** | **Left ventricular end-systolic internal diameter (mm)** | **E (m/s)** | **E/e'** | **e ' (cm/s)** |
| Survival group (*n* = 56) | 49.30 ± 3.57 | 33.78 ± 3.43 | 0.84 (0.67, 1.08) | 8.67 (7.25, 11.56) | 8.87 ± 2.37 |
| Death group (n = 46) | 49.03 ± 3.37 | 34.17 ± 3.44 | 0.79 (0.63, 1.01) | 8.85 (6.92, 11.50) | 8.41 ± 2.48 |
| *t*/*Z*/*X*2 values | 0.84 | 1.23 | 2.48 | 0.05 | 2.10 |
| *P* value | > 0.05 | > 0.05 | < 0.05 | > 0.05 | < 0.05 |

**Table 2 Univariate analysis of factors affecting the fundamental factor of patients**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **Age (yr)** | **Body mass index (kg/m2)** | **White blood cell count (×109/L)** | **Platelet count (×109/L)** | **Admission creatinine (mg/dL)** |
| Survival group (*n* = 56) | 61.96 ± 8.16 | 24.92 ± 3.15 | 14.70 ± 3.58 | 179.43 ± 53.19 | 0.88 (0.68, 1.13) |
| Death group (*n* = 46) | 61.31 ± 9.60 | 24.68 ± 3.36 | 14.57 ± 3.40 | 169.55 ± 49.70 | 0.94 (0.70, 1.20) |
| *t*/*Z*/*X*2 values | 0.78 | 0.82 | 0.41 | 2.09 | 1.50 |
| *P* value | > 0.05 | > 0.05 | > 0.05 | < 0.05 | > 0.05 |

**Table 3 Univariate analysis of factors affecting the blood system parameters of patients**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **Creatinine maximum (mg/dL)** | **Blood potassium (mmol/L)** | **Glutathione transaminase (U/L)** | **Lactic acid (mg/dL)** | **SOFA Score (Points)** |
| Survival group (*n* = 56) | 1.43 (0.93, 2.18) | 4.75 ± 0.63 | 34.00 (26.00, 43.00) | 51.88 (39.39, 78.79) | 12.12 ± 1.87 |
| Death group (*n* = 46) | 1.67 (1.12, 2.67) | 4.76 ± 0.58 | 34.00 (25.00, 44.75) | 53.80 (39.39, 71.82) | 12.48 ± 2.04 |
| *t*/*Z*/*X*2 values | 2.88 | 0.16 | 0.61 | 0.64 | 2.00 |
| *P* value | < 0.05 | > 0.05 | > 0.05 | > 0.05 | < 0.05 |

**Table 4 Multifactorial analysis affecting the prognosis of patients with sepsis**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Factors** | **B** | **S.E.** | **Wald values** | ***P* value** | **OR value** | **95%CI** |
| E | -1.949 | 0.769 | 6.416 | 0.011 | 0.142 | 0.032, 0.643 |
| Platelet count | -0.005 | 0.003 | 4.440 | 0.035 | 0.994 | 0.989, 0.999 |
| Abdominal infection | 0.788 | 0.288 | 7.499 | 0.006 | 2.200 | 1.251, 3.868 |
| Mechanical ventilation | 3.481 | 0.305 | 130.130 | 0.000 | 32.491 | 17.866, 59.089 |
| ICU length of stay | -0.082 | 0.020 | 16.925 | 0.000 | 0.921 | 0.886, 0.958 |
| Type 2 diabetes | 0.783 | 0.391 | 4.001 | 0.045 | 2.187 | 1.016, 4.708 |
| Coronary heart disease | 1.727 | 0.682 | 6.421 | 0.011 | 5.624 | 1.479, 21.387 |

ICU: Intensive care unit.