

THE FACTORS ASSOCIATED WITH MORTALITY IN SEPSIS ADULT PATIENTS AT HUE CENTRAL HOSPITAL 2021 - 2022

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ABSTRACT

Background: Sepsis has a high risk of mortality. Diagnosing and prognosing sepsis in the early stage play an important role, helping to reduce mortality and shorten the time of hospital stay of patients. Aims: Study the factors associated with mortality in sepsis adult patients.

Methods: 110 patients over 15 years old were diagnosed with sepsis, at the Department of Tropical Diseases and Intensive Care Unit, Hue Central Hospital from 1/2021 to 12/2022. Tracked cross-sectional descriptive study.

Results: The median age of sepsis patients was 66.4 ± 17.5 . Male/female: 62/48. The duration of onset of the disease was about 3 days. The average length of hospital stay was 2 weeks. The rates of septic shock and multi-organ failure were 32.0% and 35.5%, respectively. The mortality rate was 20.0%. The heart, liver, respiratory, and kidney are the organs with the highest rates of dysfunction. There was a statistically significant difference in the time of hospital stay, the number of dysfunction organ, serum urea and creatinine between the two groups of death and survivors ($p < 0.01$). The SOFA score of patients who died gradually increased compared to the SOFA score at the admission, the survivors had a decrease in SOFA scores over time.

Conclusions: The majority of sepsis patients > 60 years old (66.4%), the proportion of males was higher than females. The rates of septic shock and multiple organ failure were 31.8% and 35.5%, respectively. The mortality rate was 20.0%. The heart, liver, respiratory, and kidney are the organs with the highest rates of organ failure. Factors that were independently associated with mortality in sepsis patients were SOFA_T24, serum creatinine and number of dysfunctional organs.

Keywords: Sepsis, prognostic factor, mortality.

I. INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. The progression from sepsis to septic shock, multiple organ failure and mortality is very quickly in some cases. When the disease has progressed to late-stage shock and multiple organ failure, resuscitation becomes less effective. Therefore, diagnosis and prognosis in the early stages play a very important role, not only helping to detect and treat sepsis promptly, but also helping to reduce

mortality and shorten the septic patient's hospital stay [1]. International experts have proposed some scales and serum markers to evaluate the severity and risk of mortality of sepsis [2]. Up to now, in the Central region of Vietnam, there have not been many studies evaluating mortality prognostic factors in septic patients. Therefore, we carried out this project with the following aims: Describe some clinical and paraclinical characteristics in adult septic patients and analyse of factors associated with mortality due to sepsis in adult patients.

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II. MATERIALS AND METHODS

2.1. Research subjects

All septic patients over 15 years old, treated at the Department of Tropical Diseases and Intensive Care Department, Hue Central Hospital, during the period from January 2021 to December 2022. Diagnosis criteria for sepsis: According to SEPSIS-3 Consensus (2016): Patients are diagnosed with sepsis when they have a SOFA score ≥ 2 and have positive blood culture results or suspected or confirmed infection foci. Exclusion criteria: Patients have at least one of the following diseases: end-stage cancer, end-stage renal failure, Child C cirrhosis

2.2. Methods

Cross-sectional descriptive study with follow-up. Septic patients were examined clinically, did paraclinical tests, evaluated the SOFA score and serum lactate concentration test at 2 times: at admission (T0) and 24 hours after admission (T24).

2.3. Data processing

All research data were entered and processed using SPSS 20.0 statistical software. Qualitative variables are described by frequency distribution and percentage. Compare proportions using the chi-square test and Fisher's test if a cell in the table has a value < 5 . Compare the SOFA score and serum lactate concentration between 2 different groups using the Mann-Whitney U test to accreditation. The difference is statistically significant when $p < 0.05$.

III. RESULTS

The majority of septic patients are > 60 years old (66.4%), with a high average age (66 years old), and a higher proportion of men than women (Table 1). Patients with sepsis had a fairly acute onset of illness: average about 4 days. The average hospital stay is about 2 weeks. The rates of septic shock and multi-organ failure were 31.8% and 35.5%,

respectively; The mortality rate is 20.0% (Table 2). There is a statistically significant difference in the factors of hospital stay and number of dysfunctional organs between the two groups of dead and alive ($p < 0.01$) (Table 3).

Table 1: Characteristics of age and gender of septic patients (n=110)

Characteristics		n	%
Age	16 - 40	9	8.2
	> 40 - 60	28	25.5
	> 60	73	66.4
Average age		66.4 \pm 17.5	
Gender	Male	62	56.4
	Female	48	43.6

Table 2: Clinical characteristics of septic patients (n=110)

Characteristics	Median	IQR
Number of days of illness onset	3	2 -5
Number of days in hospital	15	10-20
	n	%
Severe cases	39	35.5
Septic shock	35	31.8
Multi-organ failure	39	35.5
Mortality	22	20.0

Cardiological, liver, respiratory and kidney systems are the organ systems with the highest rate of dysfunction. Cardiological and respiratory disorders have the highest mortality rate by dysfunctional organs (Figure 1).

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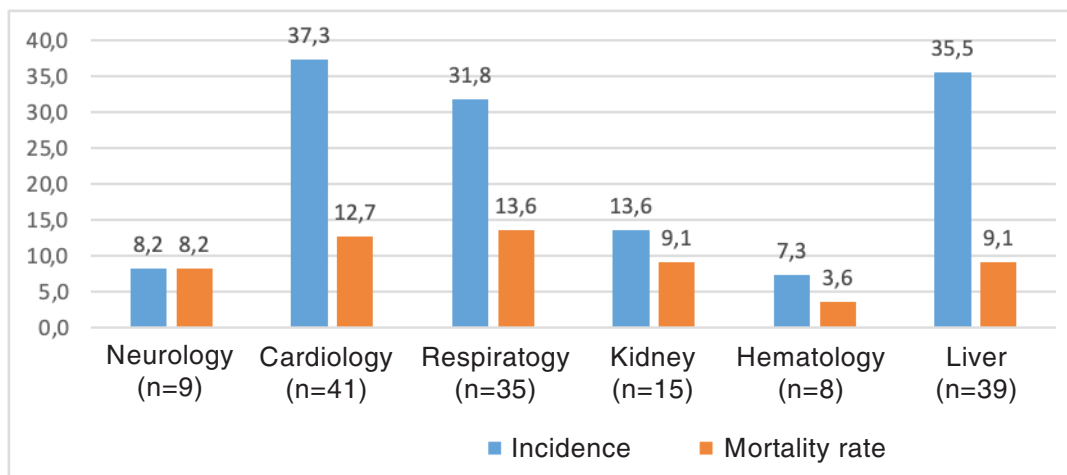


Figure 1: Incidence and mortality rates by dysfunctional organs in septic patients (n=110)

Table 3: The relationship of some clinical characteristics and mortality in septic patients

*Mann - Whitney U test, ** Chi square test

Clinical features	Alive	Dead	p
	Median (IQR)	Median (IQR)	
Age	67 (57 - 79)	66 (59 - 76)	0.8*
Number of days of illness onset	3 (2 - 5)	4 (2 - 7)	0.2*
Number of days in hospital	15 (12 - 20)	9 (5 - 11)	0.000*
Number of dysfunctional organs	1 (0 - 1)	3 (2 - 4)	0.000*
	%	%	
Male	75.8	24.2	0.2**
Underlying diseases	76.8	23.2	0.2**

There is a statistically significant difference in blood urea and creatinine levels between the dead and alive groups ($p < 0.01$) (Table 4). There is no statistically significant difference in serum lactate concentration at admission, after 24 hours and lactate clearance after 24 hours between the living and dead patient groups ($p > 0.05$) (Table 5). SOFA score at admission, after 24 hours, and SOFA_T24_T0 of the dead group were statistically different from the surviving group ($p < 0.05$). The death group had a gradually increasing SOFA score compared to the time of admission, while the group of surviving septic patients had a decreasing SOFA score over time (Table 6).

Table 4: Association of some paraclinical characteristics and mortality prognosis in septic patients

Subclinical features	Alive	Dead	p
	Median (IQR)	Median (IQR)	
White blood cells (K/ μ L)	16.3 (10.4 - 21.4)	19.6 (12.3 - 24.9)	0.4
Platelets (K/ μ L)	152.0 (88.0 - 234)	124.5 (61 - 299)	0.7

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Subclinical features	Alive	Dead	p
	Median (IQR)	Median (IQR)	
Ure (mmol/L)	7.7 (5.0 - 11.3)	18.7 (10.8 - 27.6)	0.000
Creatinin (µmol/L)	100.5 (75.4 - 141.9)	247.8 (116.5 - 355.2)	0.000
Total Bilirubin (µmol/L)	17.3 (10.9 - 35.3)	26.2 (8.5 - 88.9)	0.3
CRP (mg/L)	169.6 (114.0 - 243.4)	109.1 (52.1 - 245.0)	0.4
PCT (ng/mL)	15.1 (3.2 - 44.6)	11.8 (6.4 - 60.0)	0.5

Table 5: Association of serum lactate and mortality in septic patients
 Blood lactate clearance after 24 hours = (lactate_T0 - lactate_T24) x 100/ lactate_T0

Serum lactate (mmol/L)	Alive	Dead	p
	Median (IQR)	Median (IQR)	
At admission (n=87)	2.8 (2.0 - 4.9)	3.5 (2.0 - 5.9)	0.6
After 24 hours of admission (n=57)	2.1 (1.5 - 2.7)	1.8 (1.4 - 2.4)	0.7
Lactate clearance after 24 hours	34.3 (7.9 - 63.9)	45.9 (-63.5 - 66.9)	0.8

Table 6: Association of SOFA score and mortality in septic patients
 SOFA_T24_T0 = (SOFA_T24 - SOFA_T0)/ SOFA_T0

SOFA score	Alive	Dead	p
	Median (IQR)	Median (IQR)	
At admission	3 (1 - 6)	6 (3 - 9)	0.002
After 24 hours of admission	2 (0 - 6)	6 (4 - 9)	0.000
SOFA_T24_T0	0.00 (-0.33 - 0.00)	0.00 (0.00 - 0.24)	0.016

Table 7: Multivariable logistic regression analysis of factors related to mortality in septic patients

Factors	p	OR	95%
Male	0.883	0.903	0.231 - 3.525
Underlying diseases	0.407	1.991	0.391 - 10.128
SOFA_T0	0.253	0.669	0.336 - 1.332
SOFA_T24	0.048	2.290	1.036 - 5.122
SOFA_T24_T0	0.719	0.807	0.251 - 2.593
Serum creatinine concentration	0.019	1.006	1.001 - 1.011
Number of dysfunctional organs	0.005	2.821	1.361 - 5.850
Septic shock	0.188	0.308	0.053 - 1.777

IV. DISCUSSION

In this study, 110 patients who met the selection criteria were included in the study. The average age of the septic patients is 66.4 ± 17.5 years old, the youngest patient is 16 years old, the oldest patient is 101 years old, with the group > 60 years old is majority (66.4%). This result is similar to that reported by a number of domestic and foreign studies on septic patients [3, 4]. Sepsis can occur at any age but is more common in older patients. This is because the aging process affects the immune system, including both the innate immune response and the acquired immune response, in addition to accompanying chronic diseases that are common in the elderly such as diabetes, chronic kidney disease, malignant disease... are favorable factors for sepsis.

Septic patients in the study had illness onset average of about 3 days before hospitalization. The average hospital stay is about 2 weeks. Pham Thi Ngoc Thao also made similar observations when researching a group of septic patients at Cho Ray Hospital, Ho Chi Minh City: the number of days of illness onset before admission was 3 days and the average hospital stay was 11 days [7]. The above results show that the progression of sepsis is quite acute, causing patients to be hospitalized early in the first days of disease onset. And the average hospital stay of about 2 weeks is equivalent to the minimum course of antibiotics in septic patients.

The rates of septic shock and multiple organ failure in the study were 31.8% and 35.5%, respectively. The mortality rate is 20.0%. This result is equivalent to the study of E. Vestevsdottir (2011) in Iceland: mortality rate was 24.6% in 28 days and 40.4% in 1 year [8]; and lower than that of Hoang Thi Anh Thi et al: 43.3% [9]. In our study cardiological, liver and respiratory system accounted for the highest rate of organ failure, 37.3%, 35.5% and 31.8%, respectively. This result is similar to the research of some other domestic and foreign authors [10, 11]. Regarding the mortality rate related to the dysfunctional organ, the study noted that the cardiology and respiratory system are the two organ systems with the highest mortality rate in the group of septic patients. The next most affected organ is the kidney (13.6%). Organs such as hematology and neurology are less frequently, but once occurs,

it proves that the disease has progressed seriously and the mortality rate is high. Accordingly, in our study, it was noted that 9/9 septic patients with neurological disorders died.

When examining the relationship between clinical, paraclinical characteristics and mortality in the septic patients, we noted that the group that died had a statistically significant shorter hospital stay than the group that survived ($p < 0.05$). This result is similar to the study by Pham Thi Ngoc Thao, which showed that the group of septic patients who died had a statistically significant shorter hospital stay (12.7 ± 15.4 days) than the group who survived (21.5 ± 13.8 days) [7].

The group of septic patients who died had a statistically significant higher number of dysfunctional organs than the surviving group ($p < 0.05$). This result is similar to that of Pham Thi Ngoc Thao, who noted that the number of dysfunctional organs in the group of septic patients who died (4 ± 1) was statistically significantly higher than the group who survived (3 ± 1) ($p < 0.001$) [7].

The serum creatinine concentration of the septic patients who died was statistically significantly higher than the group who survived ($247.8 \mu\text{mol/L}$ ($116.5 - 355.2$) compared to $100.5 \mu\text{mol/L}$ ($75.4 - 141.9$); $p = 0.000$). According to Singri et al., patients with serum creatinine increased above 3.0 mg% may have a mortality rate of up to 40% - 50% [12]. According to the PICARD study, the mortality rate of acute kidney failure in intensive care units is 24 - 62%, similar to the BEST Kidney study, which surveyed 54 intensive care units in 23 countries, the overall mortality of acute kidney failure is 60.2% and septic shock is the most common cause of acute kidney failure (accounting for 48%) [13, 14]. According to the results of a multicenter study by Bagshaw and colleagues on 120,123 septic patients, the rate of patients with acute kidney injury in the first 24 hours of hospitalization was 27.8%. Among them, septic patients with acute kidney injury have a 1.6 times higher risk of mortality; hospital stay was longer and correlated with all stages of acute renal failure according to the RIFLE classification [15].

Multicenter study by Chebl RB and Thomas-Rueddel in 2015 with 988 septic patients and Chebl R. (2019, $n = 16,477$) showed that increased serum

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lactate concentration increased the risk of mortality in septic patients [16]. However, our study did not record any statistically significant differences in serum lactate concentration at admission, after 24 hours, and blood lactate clearance after 24 hours between the living and dead patient groups ($p > 0.05$). Perhaps the sample size in this study is not large enough, the above relationship cannot be clarified.

Our study shows that the SOFA score at admission, after 24 hours, and the rate of change in SOFA score at 24 hours compared to admission of the dead group are statistically different from the surviving group ($p < 0.05$). The death group had a gradually increasing SOFA score over time, while the group of surviving septic patients had a decreasing SOFA score over time. The SOFA score at admission of the dead group was statistically significantly higher than that of the surviving group (6 points (3-9) vs 3 points (1-6); $p = 0.002$). The SOFA score after 24 hours of hospitalization of the dead group was statistically significantly higher than the surviving group (6 points (4-9) vs 2 points (0-6); $p = 0.000$). The rate of change in SOFA score after 24 hours of hospitalization in the dead group was significantly higher than the surviving group (0.00 (0.00 - 0.24) vs. 0.00 (-0.33 - 0), $p = 0.016$). This result is similar to that of Huynh Quang Dai (2011) on 43 patients with severe sepsis at Cho Ray Hospital, and Pham Van Lich (2018) on 78 severe septic patients at Dak Lak Provincial General Hospital and Phan Kim Chau Man (2022) studied on 84 septic patients at Hue Central Hospital: SOFA scores of the dead septic patient was statistically significantly higher than the group of surviving patients [5, 17, 18]. The above results show that monitoring SOFA scores during treatment is valuable in assessing the prognosis of septic disease. This is because the SOFA score was developed to objectively and quantitatively describe the level of organ failure over time and predict mortality in septic patients.

When analyzing multivariable regression, the study showed that the factors related to the prognosis of mortality in septic patients were SOFA_T24, serum creatinine concentration and number of dysfunctional organs with OR of 2.290; 1.006 and 2.821, respectively. The difference is statistically significant with $p < 0.05$.

V. CONCLUSION

The majority of septic patients are older patients over 60 years old (66.4%), men are the majority. The rates of septic shock and multi-organ failure were 31.8% and 35.5%, respectively. The mortality rate is 20.0%. The cardiology, liver, kidneys, respiratory system and are the organs with the highest rate of failure. Factors independently associated with mortality in septic patients are SOFA score after 24 hours of admission, serum creatinine concentration and number of dysfunctional organs.

Disclosure

The authors report no other conflicts of interest in this work

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