

Pattern of organ failure and predictors of mortality in septic shock patients in 108 Military Central Hospital

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Summary

Objective: To describe pattern of multi-organ failure and predictive factors of mortality in septic shock patients with multi-organ failure treated at 108 Military Central Hospital. **Subject and method:** A prospective cross-sectional study was conducted on 98 septic shock patients with multi-organ failure in 108 Military Central Hospital from 2017 to 2018. These patients fulfilled septic shock criteria according to Survival Sepsis Campaign (SSC) 2016. Diagnosis of multiple organ failure was based on the modified Klaus criteria 2005. Patients were divided into two groups: Survival and death. These two groups were compared to find out some prognostic factors. **Result and conclusion:** The majority of patients was older than 60, male patients accounted for 66.3%. The common comorbidities in our study were diabetes (35.7%), hypertension (30.6%), cirrhosis (25.5%). The most common organ failures was respiratory (71.4%), followed by kidney (62.9%), liver (57.5%). The higher the number of organ failure, the higher the mortality rate was. The general mortality rate was 63.3%. Three independent predictors of mortality in septic shock patients with multi-organ failure were ARDS, APACHE II > 22, SOFA > 9.

Keywords: Septic shock, multi-organ failure, predictive factors of mortality.

1. Background

Septic shock with multi-organ failure is a serious medical condition that resulted from dangerously low blood pressure and abnormalities in cellular metabolism caused by excessive inflammatory response to serious infection [4], [5]. Multiple organ failure (MOF) is the main cause of death in ICUs, especially affecting septic patients. It is strongly related to number of systems with failure and type of system involved. The mortality rate of septic shock with multi-organ failure ranges from 60 to 80% [4], [5]. Studies showed that pattern of multi-organ failure varied in a particular group of

patient, including: number of organ failure, sequence, time and which organ failure occurs first [6], [7].

A number of risk factors of MOF and death predictors have been evaluated such as: age, APACHE II, SOFA score, inappropriate resuscitation, serum lactat, ARDS... [3], [6], [7]. However, studies resulted in different conclusions. The majority of these studies were conducted on heterogeneous group of patients. The sample size was limited. Based on that, we conducted this study with purpose: To *describe pattern of multi-organ failure and predictors of mortality in septic shock patients with multi-organ failure treated at 108 Military Central Hospital.*

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2. Subject and method

2.1. Subject

98 septic shock patients with multi-organ failure treated in ICU of 108 Military Central Hospital and Institute of Clinical Infectious Disease of 108 Military Central Hospital from January 2017 to July 2018. These patients fulfilled septic shock criteria according to Survival Sepsis Campaign (SSC) 2016 [4]. Diagnosis of multiple organ failure was based on the modified Klaus criteria 2005.

2.2. Method

A prospective cross-sectional study was conducted. Clinical data was collected by a standard questionnaire. Participants were divided into 2 groups: Death and survivor. Measurement parameters were: Age, gender, comorbidities, organ failure and number of organ failure, ARDS, APACHE II score, SOFA score. Two groups of patients were compared. Data were analyzed by software SPSS 22.0.

3. Result

3.1. Pattern of MOF in septic shock

Table 1. Gender and age

Features		Cases (n = 98)	Percentage %
Age	> 18 - ≤ 60	34	34.7
	> 60	64	65.3
Gender	Male	65	66.3
	Female	33	33.7

Patients > 60 accounted for 65.3%. Male patients accounted for 66.3% nearly twice higher than rate of female patients (33.7%).

Table 2. Comorbidities

Comorbidities	Cases (n = 98)	Percentage %
Diabetes	35	35.7
Hypertension	30	30.6
Liver cirrhosis	25	25.5
Stroke	10	10.2
CKD	9	9.2
COPD	5	5.1

Diabetes, hypertension, liver cirrhosis were the most common comorbidities with corresponding rates of 35.7%, 30.6% and 25.5%.

Table 3. Percentage of organ failure

Organ failure	Cases	Percentage %
Kidney	56/89	62.9
Respiratory	70/98	71.4
Liver	42/73	57.5
CNS	38/88	47.5

DIC	18/98	18.4
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The most common organ failure was ARDS (accounted for 71.4%), kidney failure (62.9%), followed by liver failure (57.5%) and DIC (18.4%).

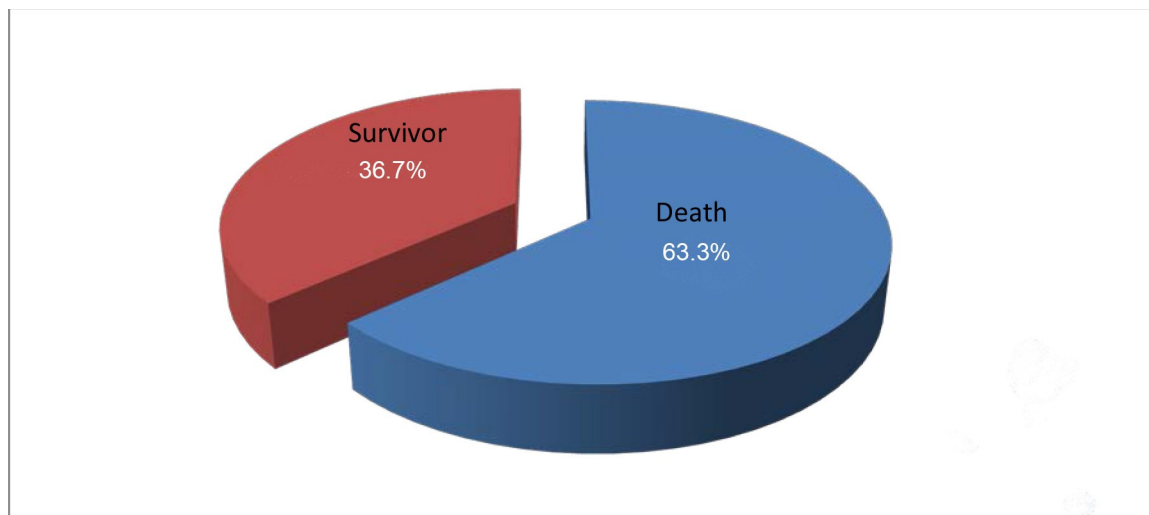


Figure 1. Outcome

The mortality rate of patients with septic shock in our study was high (63.3%).

3.2. Some predictive factors of death

Table 4. Correlation between organ failures and mortality rate

Organ failure	Survivor (n = 36)		Death (n = 62)		p	OR (95%CI)
	Cases	%	Cases	%		
ARDS	13	36.1	56	90.3	0.000	1.1 (0.2 - 2.6)
Non – ARDS	23	63.9	06	9.7		
Liver failure	12	33.3	30	48.4	>0.05	0.53 (0.23 - 1.3)
Non - liver failure	24	66.7	32	51.6		
Kidney failure	20	55	36	58.1	>0.05	0.9 (0.4 - 2.1)
Non - kidney failure	16	44.4	26	41.9		
CNS failure	11	30.6	27	43.5	>0.05	0.6 (0.23 - 1.36)
Non - CSF failure	25	69.4	35	56.5		
DIC	5	13.9	13	21.0	>0.05	0.6 (0.2 - 1.87)
Non - DIC	31	86.1	49	79.0		

Comment: Mortality rate of patients with ARDS was 90.3%, which was statistically higher than that of patients without ARDS (9.7%) with $p < 0.001$ and OR = 1.1. There were no statistically different outcomes between patients with or without liver failure, kidney failure, CNS failure, DIC.

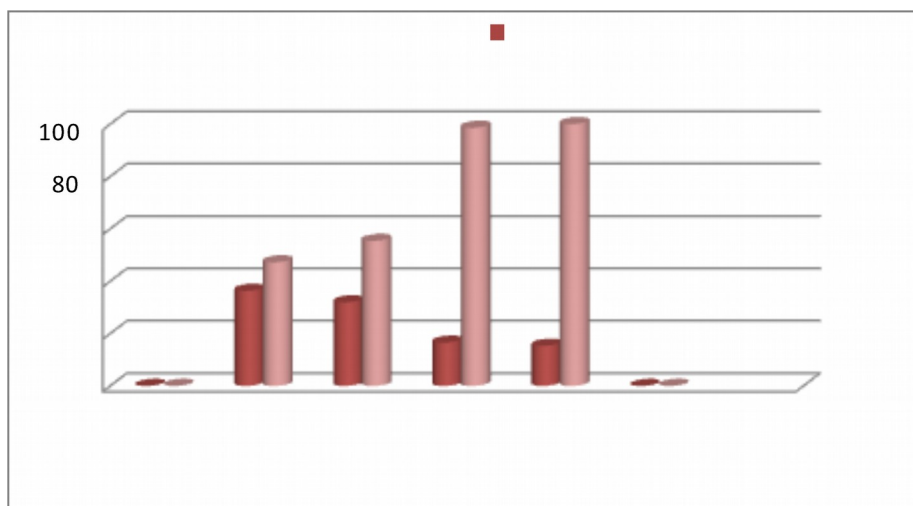


Figure 2. Correlations between number of organ failure and mortality rate

The mortality rate increased with the number of organ failure. Mortality rates of patients with 2, 3, 4, 5 organ failure were 47.2%, 55.4%, 98.6% and 100%, respectively.

Table 5. Correlations between SOFA score, APACHE II score with mortality rate

Score		Survivor (n = 36)		Death (n = 62)		p	OR (95%CI)
		n	%	n	%		
SOFA	> 9	18	50.0	51	82.3	=0.001	2.1 (1.2 - 5.4)
	≤ 9	18	50.0	11	17.7		
APACHE	> 22	9	33.3	45	72.6	=0.000	1.2 (0.4 - 3.2)

The mortality rate of patients with SOFA score > 9 was 82.3%, which was statistically higher than that of patients with SOFA ≤ 9 (17.7%) with $p = 0.001$ and OR = 2.1.

The mortality rate of patients with APACHE II score > 22 was 76.2%, which was statistically higher than that of patients with APACHE II score ≤ 22 with $p < 0.001$ and OR = 1.2.

4. Discussion

4.1. Baseline characteristics of study group

Age and gender

Our study showed that patients > 60 accounted for 65.3%. Male patients accounted for 66.3% almost twice higher than rate of female patients (33.7%). The rate of patients older than 60 in our study was higher than that of Dinh Ha

Giang (31.8%) [1]. The rate of male patients in our study was similar to results of Hoang Thi Hanh: male patients accounted for 63.6% [2]. It is believed that septic shock patients could be at any age, however older people are at high risk of having septic shock because these patients often have comorbidities such as diabetes, hypertension, COPD, liver cirrhosis. Elderly also have immunosuppress to some extent which is more favor to a worse progress in sepsis and

septic shock. The number of male patients in our study was higher than female because a number of chronic conditions such as tobacco abuse, COPD, alcoholic liver diseases and liver cirrhosis were more common in male.

Chronic diseases

Diabetes, hypertension, liver cirrhosis were the most common comorbidities accounted for 35.7%, 30.6%, 25.5%, respectively, followed by stroke 10.2%, chronic kidney disease 9.3%, COPD 5.1%. The study of Dinh Ha Giang showed that the common comorbidities were cardiovascular diseases (13.2%), liver cirrhosis (11.3%), CKD (7.5%), diabetes (3.8%)... [1]. Our study results were similar to the that of Hoang Thi Hanh conducted at 108 Military Central Hospital [2]. Septic patients with chronic health diseases are at risk of having septic shock, consequently apart from well managing their comorbidities, it is crucial to prevent infections on these patients.

Percentages of organ failure: According to Table 3, the most common organ failure was respiratory system accounted for 71.4%, followed by kidney failure 62.9%, liver failure 57.5%, and DIC 18.4%. The studies of Hoang Van Quang and Marshall B showed that: the most common organ failure was respiratory system [3], [7]. In our study, respiratory system was the most common first site of infection and a number of patients had pneumonia related to ventilator, and then consequently respiratory failure was the most common organ failure in our study.

Outcome: Mortality rate in our study was 63.3%, higher than that of Dinh Ha Giang (32.1%) [1] and Marshall B [7]. It could be explained by the fact that our patients were delivered to our hospital from variety of local hospitals in severe conditions and a number of patients had hospital acquired pneumonia which was hard to treat successfully.

4.2. Some predictive factors of mortality

Correlations between ARDS and mortality

A number of studies demonstrated the fact that lungs worked as "first filters", activating cells such as neutrophils, lymphocytes, cytokines, lots of mediators leading to an increased capillary permeability, and fibrin-platelet aggregation due to activation of PAF and other septic mediators. That is the mechanism of ARDS which is indication for mechanical ventilation.

In our study, patients with ARDS had markedly high mortality rate of 90.3% when compared with mortality rate in patients without ARDS (only 9.7%). The difference was statistically significant with $p < 0.001$ and OR = 1.1. The study of Regel showed similar result as ours that respiratory failure was correlated with the highest mortality rate [6].

Table 4 also indicated that, other organ failures such as liver, kidney, CNS and DIC had no statistically significant correlation with mortality rate.

Correlation between number of organ failure and mortality rate

Figure 2 demonstrated that the mortality increased with the number of organ failure. Mortality rates of patients with 2, 3, 4, 5 organ failures were 47.2%, 55.4%, 98.6% and 100% respectively. These results were similar to those of Hoang Thi Hanh [2]. Marsall B also illustrated that the mortality rates in patients with 1, 2, 3, 4, 5 organ failure were 6.8%, 26.2%, 48.5%, 68.8% and 83.3%, respectively [7]. Elizabeth studied severe septic patients and noted that the mortality rate in patients with 1 organ failure was 18%, with 2 - 3 organ failure was 52% and with 4 organ failure was the highest 88% [8]. In septic shock, patients had and overwhelming inflammatory response, leading to a progressive deterioration of organ function which made the mortality rate high.

Correlations between SOFA score, APACHE II score with mortality rate

Regarding to SOFA score, our study showed that the mortality rate of patients with SOFA score > 9 was 82.3%, statistically higher

than that of those with SOFA ≤ 9 (17.7) with $p=0.001$ and OR = 2.1. The studies of Hoang Van Quang and Hoang Thi Hanh also indicated that SOFA score > 9 was a predictive factor of mortality [3].

Table 5 also demonstrated that mortality rate of patients with APACHE II score > 22 was 72.6%, statistically higher than that of patients with APACHE II score ≤ 22 with $p<0.001$ and OR = 1.2.

Our study result was similar to those of Hoang Thi Hanh [2], and Hoang Van Quang [3]. They had stated that APACHE II score > 22 was an independent predictor of mortality [3]. Elizabeth also demonstrated that APACHE II score > 24 was a significant indicator of death. In conclusion, APACHE II score was useful as predictive factor of mortality in septic shock patients.

5. Conclusion

Pattern of organ failure: The most common organ failures was respiratory system (71.4%), followed by kidney (62.9%), liver (57.5%). The higher the number of organ failure, the higher the mortality rate was. The general mortality rate was 63.3%.

Three independent predictors of mortality in septic shock patients with multi-organ failure were ARDS, APACHE II > 22 and SOFA > 9 .

References

1. Dinh Ha Giang (2016) *Study clinical characteristic and pattern of organ failure in septic shock patient*. General doctor graduated assay, Ha Noi Medical University.
2. Hoang Thi Hanh (2018) *Study predictive factors of mortality in septic shock patients with multi organ failure caused by gram negative bacteria failure treated at 108 Military Central Hospital from 2016 to 2018*. Clinical medical and pharmaceutical journal 108: 44-50.
3. Hoang Van Quang, Le Huy Bao (2012) *Validation of clinical scores evaluated multi-organ failure as predictors of mortality in septic shock patients*. Ho Chi Minh Medical University 16(1): 167-173.
4. Andrew Rhodes (2016) *Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016*. 2017 SCCM and ESICM.
5. Micheals, Pobert K et al (2005) *Improving care of the patient with severe sepsis and septic shock*. Contemporary Care Medicine 3(5): 1-11.
6. Regel G, Grotz M, Weltner T et al (1996) *Pattern of organ failure following severe trauma*. World J. Surg (20): 422-429.
7. Marshall B, John C, Cook et al (1995) *Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome*. Crit Care Med 23(10): 1638-1652.
8. Elizabeth B, Desanka D, Sanja D et al (2001) *Multiple organ failure in septic patients*. Razilian journal of infectious diseases, Salvado june 5(3): 1-8.