# The prognostic factors in sepsis patients after operation of gastrointestinal tumors in ICU

**Ren-Xiong Chen**
Key Laboratory of Carcinogenesis and Translational Research (Ministry of Education), Peking University Cancer Hospital & Institute https://orcid.org/0000-0003-0471-3449

**Zhou-Qiao Wu**
Beijing Cancer Hospital

**Zi-Yu Li**
Beijing Cancer Hospital

**Hong-Zhi Wang** ( wanghz58@sina.com )
https://orcid.org/0000-0003-0985-2157

**Jia-Fu Ji**
Beijing Cancer Hospital

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**Research**

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# Abstract

*Objectives*: We studied the clinical profiles and the prognostic factors in patients with sepsis after thegastrointestinal tumor surgery in ICU.

*Methods*: We retrospectively screened patients who underwent the gastrointestinal tumor surgery at the Peking University Cancer Hospital from January 2015 to December 2019. Among them, 181 patients who were diagnosed with sepsis in ICU were enrolled in our study. Cox regression was performed for multivariate adjusted factor analyses.

*Results*: The 90-day all-cause mortality rate was 11.1% in our study. The univariate analysis showed that BMI, shock within 48h after entering ICU, number of blood leukocytes, the ratio of lymphocytes to neutrophils, INR, creatinine, procalcitonin, lactic acid, oxygenation index, SOFA score within 24h after entering ICU, APACHE II score within 24h after entering ICU were statistically significant. In multiple analysis, we found that BMI□20kg/m$^2$ was a protective factor, while lactic acid□3 mmol/L after entering ICU and APACHE II score□20 within 24h after entering ICU were independent risk factors for the prognosis of sepsis after the gastrointestinal tumor surgery in ICU.

*Conclusions*: The 90-day all-cause mortality rate was 11.1% in our study. BMI□20kg/m$^2$ was a protective factor, while lactic acid□3 mmol/L after entering ICU and APACHE II score□20 within 24h after entering ICU were independent risk factors for the prognosis of sepsis after the gastrointestinal tumor surgery in ICU.


# Background

Sepsis was a worldwide problem. It is estimated that there are 31.5 million patients with sepsis every year in the world, which causes about 5.3 million deaths every year [1]. Sepsis is associated with high mortality. About 14000 people died of its complications every day in the world. Sepsis can be caused by any types of infection. Pathogenic microorganisms include bacteria, fungi, viruses and parasites. As the previous definition of sepsis (infection+SIRS) is too sensitive, the new definition of sepsis is the life-threatening organ dysfunction caused by the host's maladjusted response to infection. Organ dysfunction manifests that sepsis-related organ failure score was no less than two points [2].

The most common postoperative infection of gastrointestinal tumor is abdominal infection. Early identification of infection, control of infection source, proper use of antibiotics and rapid resuscitation of critical patients are the cornerstone of abdominal infection management [3-6]. There are numerous factors affecting the prognosis of sepsis. It has been reported that the prognosis of sepsis is related to lactic acid, interleukin-6, PCT, CRP, HFABP and so on [7-11]. However, as the definition describes, sepsis is a syndrome with extreme heterogeneity. In the past, there were various reports on mortality of sepsis, though, few studies on the prognosis of patients with sepsis after operation. The purpose of this study is to investigate the prognostic factors of patients with sepsis who were admitted to ICU after gastrointestinal operation.

# Patients And Methods

### *Patients*

From January 2015 to December 2019, a total of 1636 patients were admitted to ICU after surgery from the gastrointestinal tumor center of Peking University Cancer Hospital. According to the new definition of sepsis, 181 patients diagnosed with sepsis were enrolled in this study. Exclusion criteria: patients were admitted to ICU for other reasons or did not have sepsis during ICU stay, or patients' sepsis occurred out of ICU stay.

### *Therapeutic method*

For sepsis patients, we have active anti-infection treatment, sent etiology examination and tried to find the source of infection. For patients with septic shock, we took the following measures: First, bestowed broad-spectrum antibiotics within one hour, and took the etiological examination before giving antibiotics. Second, 30 ml/kg of crystalloid fluids was used for rapid volume resuscitation within three hours, and the initial target of mean arterial pressure (MAP) was 65 mmHg. If the MAP was not achieved the target within one hour, noradrenaline was used for increasing the blood pressure. Third, we looked for and controlled the source of infection actively. For patients with a definite source of infection, we controlled the source of infection by minimally invasive drainage, surgical debridement, removal of a central venous catheter and sputum aspiration by bronchoscope, etc. To emphasize; we follow the guidelines for other treatment strategies [5, 6].

### *Data collection and follow-up*

The clinical data and laboratory examination of the patients were collected as follows: age, body mass index (BMI), underlying diseases, the length of the first operation, pathogen susceptibility test, antibiotics used, whether shock occurred within 48 hours after entering ICU, the number of blood leukocytes, lymphocyte percentage, neutrophil percentage, international standardized ratio (INR), activated partial thromboplastin time (APTT), albumin, creatinine, cardiac troponin I (TNI), procalcitonin (PCT), lactic acid (Lac), base excess (BE), oxygenation index (PaO2 / FiO2) after entering ICU, sequential organ failure (SOFA) score and acute physiological function and chronic health evaluation ( APACHE) II score within 24h after entering ICU. Unless otherwise stated, the first test after entering ICU was used for analysis. They were followed up to 90 days in the clinic or by phone call.

### *Statistical analyses*

The data of continuous variables were statistically described by mean ± standard deviation. The non-continuous variables were described by median (quartile 1 [Q1], quartile 3 [Q3]). The counting variables were described by numerical value (percentage). The Kaplan-Meier method was used to calculate the survival rate of patients and log-rank test was used for the univariate analysis. Cox regression was used for the multivariate adjusted analyses with forward LR method. Statistical analyses were carried out using SPSS version 24.0 and *P* values less than 0.05 (two-tailed) were considered significant.

# Results

### *Patient characteristics*

According to the new definition of sepsis, a total of 181 patients were diagnosed with sepsis and 86 of them were diagnosed with septic shock within 48 hours after entering ICU. There were 13 patients complicated by abdominal bleeding or gastrointestinal bleeding, 16 cases by deep-vein thrombosis, one case by cerebral infarction and one case by myocardial infarction. See Table 1 for baseline characteristics of patients.

### *The Univariate and multiple survival analyses*

The univariate analysis is shown in Table 2. All the sepsis patients were followed up for 90 days; 20 patients died, and the 90-day all-cause mortality rate was 11.1%. Univariate analysis showed that there were statistically significant differences in BMI, shock within 48h after entering ICU, the number of blood leukocytes, the ratio of lymphocyte to neutrophil, INR, creatinine, PCT, Lac, BE, oxygenation index after entering ICU, SOFA score and APACHE II score within 24h after entering ICU. Among them, BMI more than 20 kg/$m^2$ was a protective factor; the others were risk factors. Especially, shock within 48h after entering ICU, INR, creatinine, Lac, oxygenation index after entering ICU, SOFA score and APACHE II score within 24h after entering ICU had P values less than 0.01.

See Table 3 for multiple analyses. Those factors with P values less than 0.05 were enrolled in the Cox regression analysis. The results showed that BMI, lactic acid after entering ICU and APACHE II score within 24h after entering ICU were independent prognostic factors. The BMI□20kg/$m^2$ was a protective factor, while lactic acid□3 mmol/L after entering ICU and APACHE II score□20 within 24 hours after entering ICU were risk factors. The survival curves of these three factors are shown in Figure 1, figure 2 and figure 3.

# Discussion

Sepsis is one of the most common causes of death in critically ill patients. At present, there are only a few studies focused on postoperative sepsis. This study focuses on sepsis after operation of gastrointestinal tumor. In this study, the mortality rate is lower than that of sepsis reported in the literature [12], which may be related to the fact that most of the infection sources of the patients we selected are abdominal infection, and we can actively control the infection sources by multidisciplinary cooperation. In this study, 181 patients with sepsis who were admitted to ICU after operation of gastrointestinal tumor were analyzed retrospectively and we found that BMI□20kg/$m^2$, lactic acid□3 mmol/L after entering ICU and APACHE II score□20 within 24h after entering ICU were independent pro gnostic factors.

The World Health Organization classified BMI as follows: BMI□18.5kg/$m^2$ was underweight, 18.5≤BMI□25 kg/$m^2$ was normal weight, 25≤BMI□30kg/$m^2$ was overweight and BMI≥30kg/$m^2$ was obesity [13]. In this study, we found that patients with BMI□20kg/$m^2$ had a better prognosis than those with BMI≤20kg/$m^2$,

so we guessed that BMI≤20kg/$m^2$ might be a protective factor. However, the number of patients in this study was limited, and we did not conduct a more detailed stratified study. There were numerous reports about the relationship between BMI and the prognosis of sepsis, though the results were still controversial [14, 15]. Matthaios PO et al. [16] found that the mortality of obese patients with sepsis increased significantly. But one recent meta-analysis divided sepsis patients into three groups: overweight (25≤BMI≤30kg/$m^2$), obesity (30≤BMI≤40kg/$m^2$) and morbid obesity (BMI≥40kg/$m^2$). The results showed that the death risk of overweight patients with sepsis was reduced, while obesity and morbid obesity patients with sepsis did not increase the death risk. The reason for this controversy might be related to the distribution of adipose tissue. It was reported that the visceral fat (VAT) accumulation detected by CT scan was a risk factor for poor prognosis of sepsis. Sepsis patients with a high ratio of VAT area to the subcutaneous fat (SAT) area had an increased risk of death and organ damage [17]. In future, more detailed and rigorous studies should be designed to clarify the relationship between sepsis and BMI.

Lactic acid was constantly produced in metabolism and exercise, but its concentration generally did not rise. Only when the production of lactic acid was accelerated and lactate could not be removed in time, its concentration would increase. Generally speaking, when the energy of the tissue could not be satisfied by aerobic respiration, the tissue could not get enough oxygen or could not deal with oxygen fast enough, the concentration of lactic acid would rise. Hence, sepsis and septic shock guidelines used lactic acid as an indicator of tissue hypoperfusion and as a target for fluid resuscitation [5, 6]. Many studies had shown that lactate was an independent risk factor for sepsis prognosis [18-20]. In our study, it was also confirmed that the lactic acid≥3 mmol/L after entering ICU was an independent risk factor for sepsis patients after the gastrointestinal tumor surgery.

There were many scoring systems for evaluating the severity of critical patients, such as SOFA score and APACHE II score [21-23]. APACHE II score was considered as the gold standard for risk assessment of critical patients in the past. Several studies confirmed that APACHE II score is an independent risk factor for the prognosis of sepsis patients [24, 25]. In our study, we found that the SOFA score and APACHE II score within 24 hours after entering ICU were statistically significant in the univariate analysis, while the multivariate analysis showed that only APACHE II score≥20 was an independent risk factor in this group. However, there was evidence that APACHE II score might provide inaccurate information in some patients, for example, in patients with unconsciousness, the score might be too high [26]. Therefore, we need to increase the sample size to confirm this result in the future.

The limitations of this study should be referred. First, this study was a retrospective study and the subjects of this study were patients with sepsis who were admitted to ICU after operation of gastrointestinal tumor, so, whether the results could be extended to all sepsis populations remains to be confirmed. Second, patients with sepsis in the general ward were not included in this study, and most of these patients improved in our hospital. Therefore, the mortality of patients with sepsis after gastrointestinal surgery might be overestimated in our study. In the future, we will design prospective research to verify it. Third, there were several missing data, especially BNP, echocardiography, etc. So we

could not accurately evaluate their impact on the prognosis of sepsis patients. Finally, the small sample size of this study increased the risk of type two error which made the study power limited. We hope that there will be more large-scale researches to confirm these results in the future.

# Conclusions

The 90-day all-cause mortality rate was 11.1% in our study. BMI≥20kg/$m^2$ was a protective factor, while lactic acid≥3 mmol/L after entering ICU and APACHE II score≥20 within 24 hours after entering ICU were independent risk factors for the prognosis of sepsis after the gastrointestinal tumor surgery in ICU.

# Declarations

### Ethics approval and consent to participate

We received the approval of the Medical Ethical Committee of Peking University Cancer Hospital. All patients or their near kin in our study provided informed consent.

### Consent for publication

Not applicable.

### Availability of data and materials

Data will be shared after this study is published.

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The authors received no specific funding for this work.

### Authors' contributions

Ren-Xiong Chen designed the study and drafted the manuscript. Hong-Zhi Wang and Jia-Fu Ji critically revised the manuscript. Zhou-Qiao Wu participated in the study design and helped to perform statistical analysis. Zhou-Qiao Wu and Zi-Yu Li helped draft the manuscript. All authors read and approved the final manuscript.

### Authors' information

Ren-Xiong Chen was attending Doctor of ICU and doctoral candidate of Department of Gastrointestinal Surgery at Peking University Cancer Hospital & Institute

Professor Hong-Zhi Wang was the chief of ICU.

Professor Jia-Fu Ji was the chief of Department of Gastrointestinal Surgery.

# Abbreviations

BMI: body mass index; INR: International standardized ratio; APTT: activated partial thromboplastin time; TNI: cardiac troponin I; PCT: procalcitonin ; Lac; lactic acid; BE: base excess; SOFA score: sequential organ failure and acute score; APACHE II score: Acute Physiology and Chronic Health Evaluation II score.

# References


1.Fleischmann C, Scherag A, Adhikari NK, et al. Assessment of Global Incidence and Mortality of Hospital-treated Sepsis. Current Estimates and Limitations[J]. Am J Respir Crit Care Med. 2016; 193(3): 259-272.

2.Singer M, Deutschman C S, Seymour C W, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) [J]. The Journal of the American Medical Association. 2016; 315(8):775-787.

3.Sawyer R G, Claridge J A, Nathens A B, et al. Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection [J]. New England Journal of Medicine. 2015; 372(21):1996-2005.

4.Sartelli M, Catena F, Abu-Zidan FM, et al. Management of intra-abdominal infections: Recommendations by the WSES 2016 consensus conference [J]. World Journal of Emergency Surgery. 2017; 12:22.

5.Rhodes A, Evans L E, Alhazzani W, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock [J]. Critical Care Medicine. 2017;45(3):486-552.

6.Levy M M , Evans L E , Rhodes A . The Surviving Sepsis Campaign Bundle: 2018 update [J]. Intensive Care Medicine. 2018; 44(6):925-928.

7.Fraunberger P , Wang Y , Holler E , et al. Prognostic value of interleukin 6, procalcitonin, and c-reactive protein levels in intensive care unit patients during first increase of fever [J]. Shock. 2006;26(1):10-12.

8.Yanaral T U , Idin K , Uzman S , et al. The prognostic value of procalcitonin and C-reactive protein in critically ill patients A comparison with APACHE II and SOFA scores[C]// The European Anaesthesiology Congress. 2010.

9.Tanriverdi H, Tor, MügeMeltem, Kart L , et al. Prognostic value of serum procalcitonin and C-reactive protein levels in critically ill patients who developed ventilator-associated pneumonia [J]. Annals of Thoracic Medicine. 2015; 10(2):137-142.

10.Ríos-Toro Juan-Jesús, Márquez-Coello Mercedes, García-álvarez José-María, et al. Soluble membrane receptors, interleukin 6, procalcitonin and C reactive protein as prognostic markers in patients with severe sepsis and septic shock [J]. PLOS ONE. 2017;12(4):e0175254-.

11.Ryoo S M, Lee J B, Lee Y S, et al. Lactate Level Versus Lactate Clearance for Predicting Mortality in Patients With Septic Shock Defined by Sepsis-3 [J]. Critical Care Medicine. 2018;46(6):e489-e495.

12.Herrán-Monge, Rubén, Muriel-Bombín, Arturo, García-García, Marta M, et al. Epidemiology and Changes in Mortality of Sepsis After the Implementation of Surviving Sepsis Campaign Guidelines [J]. Journal of Intensive Care Medicine. 2019; 34(9):740-750.

13.Organization W H. Obesity: preventing and managing the global epidemic : report of a WHO consultation on obesity[J]. Geneva World Health Organization. 2000;894(1):18-30.

14.Trivedi V, Bavishi C, Jean R. Impact of obesity on sepsis mortality: A systematic review [J]. Journal of Critical Care. 2015; 30(3):518-524.

15.Wang S, Liu X, Chen Q, et al. The role of increased body mass index in outcomes of sepsis: a systematic review and meta-analysis [J]. BMC Anesthesiology. 2017; 17(1):118.

16.Matthaios P O, Diamanto A, Anastasia Z, et al. The Role of Obesity in Sepsis Outcome among Critically Ill Patients: A Retrospective Cohort Analysis [J]. BioMed Research International. 2016;2016:5941279.

17.isitsak C, Lee J G H, Boyd J H, et al. Increased Ratio of Visceral to Subcutaneous Adipose Tissue in Septic Patients Is Associated With Adverse Outcome [J]. Critical Care Medicine. 2016;44(11):1966-1973.

18.Malmir J , Bolvardi E , Afzal Aghaee M. Serum lactate is a useful predictor of death in severe sepsis and septic shock [J]. Reviews in Clinical Medicine. 2014;1(3):97-104.

19.Lokhandwala S, Andersen L W, Nair S, et al. Absolute lactate value versus relative reduction as a predictor of mortality in severe sepsis and septic shock [J]. Journal of critical care. 2016; 37:179-184.

20.Siddiqui I, Jafri L, Abbas Q, et al. Relationship of serum procalcitonin, c-reactive protein, and lactic acid to organ failure and outcome in critically ill pediatric population [J]. Indian Journal of Critical Care Medicine. 2018;22(2):91-95.

21.Ho K M. Combining Sequential Organ Failure Assessment (SOFA) Score with Acute Physiology and Chronic Health Evaluation (APACHE) II Score to Predict Hospital Mortality of Critically Ill Patients [J]. Anaesthesia and intensive care. 2007; 35(4):515-521.

22.Raith E P, Udy A A, Bailey M, et al. Prognostic Accuracy of the SOFA Score, SIRS Criteria, and qSOFA Score for In-Hospital Mortality Among Adults With Suspected Infection Admitted to the Intensive Care Unit [J]. JAMA. 2017; 317(3):290-300.

23.Probst L, Schalk E, Liebregts T, et al. Prognostic accuracy of SOFA, qSOFA and SIRS criteria in hematological cancer patients: a retrospective multicenter study [J]. Journal of Intensive Care. 2019; 7:41.

24.Liu X, Shen Y, Li Z. et al. Prognostic significance of APACHE II score and plasma suPAR in Chinese patients with sepsis: a prospective observational study [J]. BMC Anesthesiol. 2015;16(1):46

25.Giamarellos-Bourboulis E J , Norrby-Teglund A , Mylona V , et al. Risk assessment in sepsis: a new prognostication rule by APACHE II score and serum soluble urokinase plasminogen activator receptor [J]. Critical Care. 2012;16(4):R149.

26.Vincent J L , Opal S M , Marshall J C . Ten reasons why we should NOT use severity scores as entry criteria for clinical trials or in our treatment decisions [J]. Critical care medicine. 2010; 38(1):283-287.

# Tables

Table 1

Baseline characteristics of sepsis patients

| Baseline characteristics | Number (%) |
|---|---|
| Age, median (Q1, Q3) | 65 (59,71) |
| Sex | |
| Male | 145 (80.1) |
| Female | 36 (19.9) |
| BMI, Mean (SD), kg/m2 | 23.5 (0.3) |
| Tumor type | 91 (50.3) |
| Gastric cancer | |
| Colorectal cancer | 84 (46.4) |
| Other abdominal tumors | 6 (3.3) |
| Coexisting conditions[a] | |
| Hypertension | 64 (35.4) |
| Diabetes | 32 (17.7) |
| Coronary heart disease | 17 (9.4) |
| Chronic obstructive pulmonary disease | 11 (6.1) |
| Arrhythmia | 9 (5.0) |
| Chronic renal insufficiency | 2 (1.1) |
| Location of infection[b] | |
| Abdominal infection | 134 (74.0) |
| Enterogenous infection | 12 (6.6) |
| Intrathoracic infection | 17 (9.4) |
| Pulmonary infection | 31 (17.1) |
| Skin and soft tissue infection | 6 (3.3) |

[a] 27 patients had two or more chronic diseases.

[b] 31 patients were infected with two or more locations.

| Baseline characteristics | Number (%) |
| --- | --- |
| Surgical wound infection | 4 (2.2) |
| Central line-associated bloodstream infection | 3 (1.7) |
| Urinary tract infection | 2 (1.1) |
| Length of first operation, median(Q1,Q3), min | 195 (140,246) |
| [a] 27 patients had two or more chronic diseases. | |
| [b] 31 patients were infected with two or more locations. | |

Table 2

The univariate analysis of sepsis patients

| Items | Number (%) | Survival rate at 90-day | P value |
|---|---|---|---|
| Age, years | | | 0.840 |
| ≦ 65 | 96 (53.0) | 0.885 | |
| ▯65 | 85 (47.0) | 0.894 | |
| Sex | | | 0.254 |
| Male | 145 (80.1) | 0.876 | |
| Female | 36 (19.9) | 0.944 | |
| BMI, kg/m$^2$ | | | 0.018 |
| ≦ 20 | 37 (20.4) | 0.784 | |
| ▯20 | 144 (79.6) | 0.917 | |
| Charlson score | | | 0.356 |
| ≦3 | 142 (78.5) | 0.901 | |
| ▯3 | 39 (21.5) | 0.846 | |
| Length of first operation, min | | | 0.361 |
| ≦ 240 | 129 (71.3) | 0.876 | |
| ▯240 | 52 (28.7) | 0.923 | |
| Empirical anti infection evaluation | | | 0.729 |
| Sensitive | 132 (72.9) | 0.894 | |
| Resistance | 18 (10.0) | 0.833 | |
| No pathogen detected | 31 (17.1) | 0.903 | |
| Shock within 48 h after entering ICU | | | 0.001 |
| No | 95 (52.5) | 0.979 | |
| Yes | 86 (47.5) | 0.791 | |
| Number of blood leukocytes, $10^9$/L | | | 0.010 |

| Items | Number (%) | Survival rate at 90-day | P value |
|---|---|---|---|
| ≦4 | 31 (17.1) | 0.774 | |
| 4▯WBC ≤ 12 | 77 (42.6) | 0.963 | |
| ▯12 | 73 (40.3) | 0.863 | |
| Ratio of lymphocyte to neutrophil | | | 0.035 |
| ≦0.15 | 148 (81.8) | 0.912 | |
| ▯0.15 | 33 (18.2) | 0.788 | |
| International standardized ratio | | | 0.001 |
| ≦1.5 | 127 (70.2) | 0.937 | |
| ▯1.5 | 54 (29.8) | 0.778 | |
| Activated partial thromboplastin time, S | | | 0.064 |
| ≦ 50 | 138 (76.2) | 0.913 | |
| ▯50 | 43 (23.8) | 0.814 | |
| Albumin, g/L | | | 0.058 |
| ≦30 | 99 (54.7) | 0.848 | |
| ▯30 | 82 (45.3) | 0.939 | |
| Creatinine, umol/L | | | 0.001 |
| ≦120 | 150 (82.9) | 0.927 | |
| ▯120 | 31 (17.1) | 0.710 | |
| Cardiac troponin I, ng/ml | | | 0.063 |
| ≦0.05 | 138 (76.2) | 0.913 | |
| ▯0.05 | 43 (23.8) | 0.814 | |
| Procalcitonin, ng/ml | | | 0.011 |
| ≦5 | 93 (51.4) | 0.946 | |
| ▯5 | 88 (48.6) | 0.830 | |
| Lactic acid, mmol/L | | | 0.001 |

| Items | Number (%) | Survival rate at 90-day | P value |
|---|---|---|---|
| ≦3 | 128 (70.7) | 0.938 | |
| ▯3 | 53 (29.3) | 0.774 | |
| Base excess, mmol/L | | | 0.011 |
| ≦-3 | 101 (55.8) | 0.941 | |
| ▯-3 | 80 (44.2) | 0.825 | |
| Oxygenation index, mmHg | | | 0.003 |
| ≦200 | 97 (53.6) | 0.825 | |
| ▯200 | 84 (46.4) | 0.964 | |
| SOFA score | | | 0.001 |
| ≦8 | 124 (68.5) | 0.968 | |
| ▯8 | 57 (31.5) | 0.719 | |
| APACHE II score | | | 0.001 |
| ≦20 | 124 (68.5) | 0.976 | |
| ▯20 | 57 (31.5) | 0.702 | |

Table 3

Multiple analysis of sepsis patients

| Factors | RR | 95% interval | | *P* value |
|---|---|---|---|---|
| | | Lower limit | Upper limit | |
| BMI | 0.199 | 0.076 | 0.522 | 0.001 |
| Lactic acid | 3.333 | 1.290 | 8.610 | 0.013 |
| APACHE II score | 14.479 | 4.145 | 50.580 | 0.001 |

# Figures

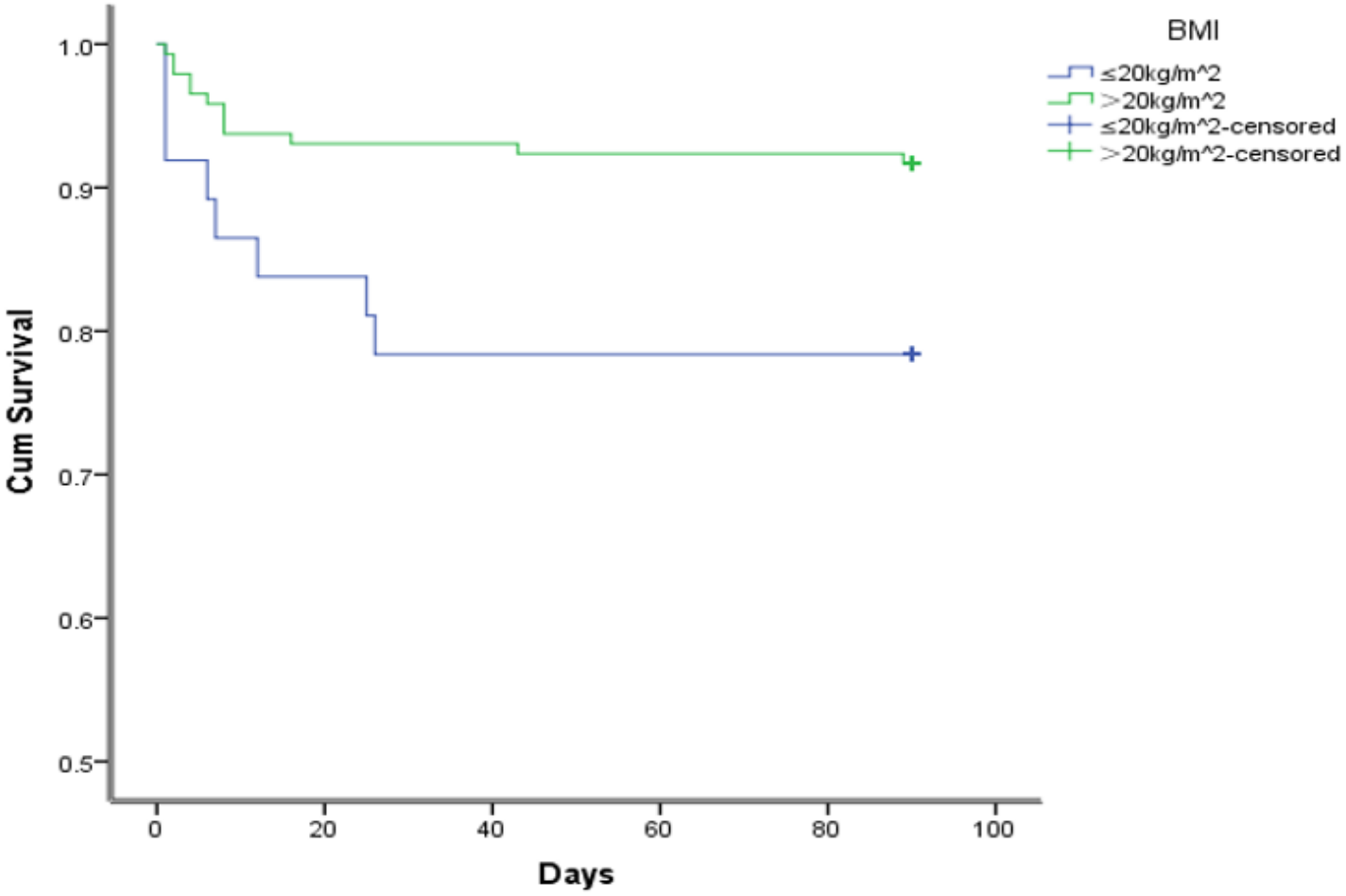


**Figure 1**

Kaplan-Meier survival curves of BMI on overall survival at 90 days

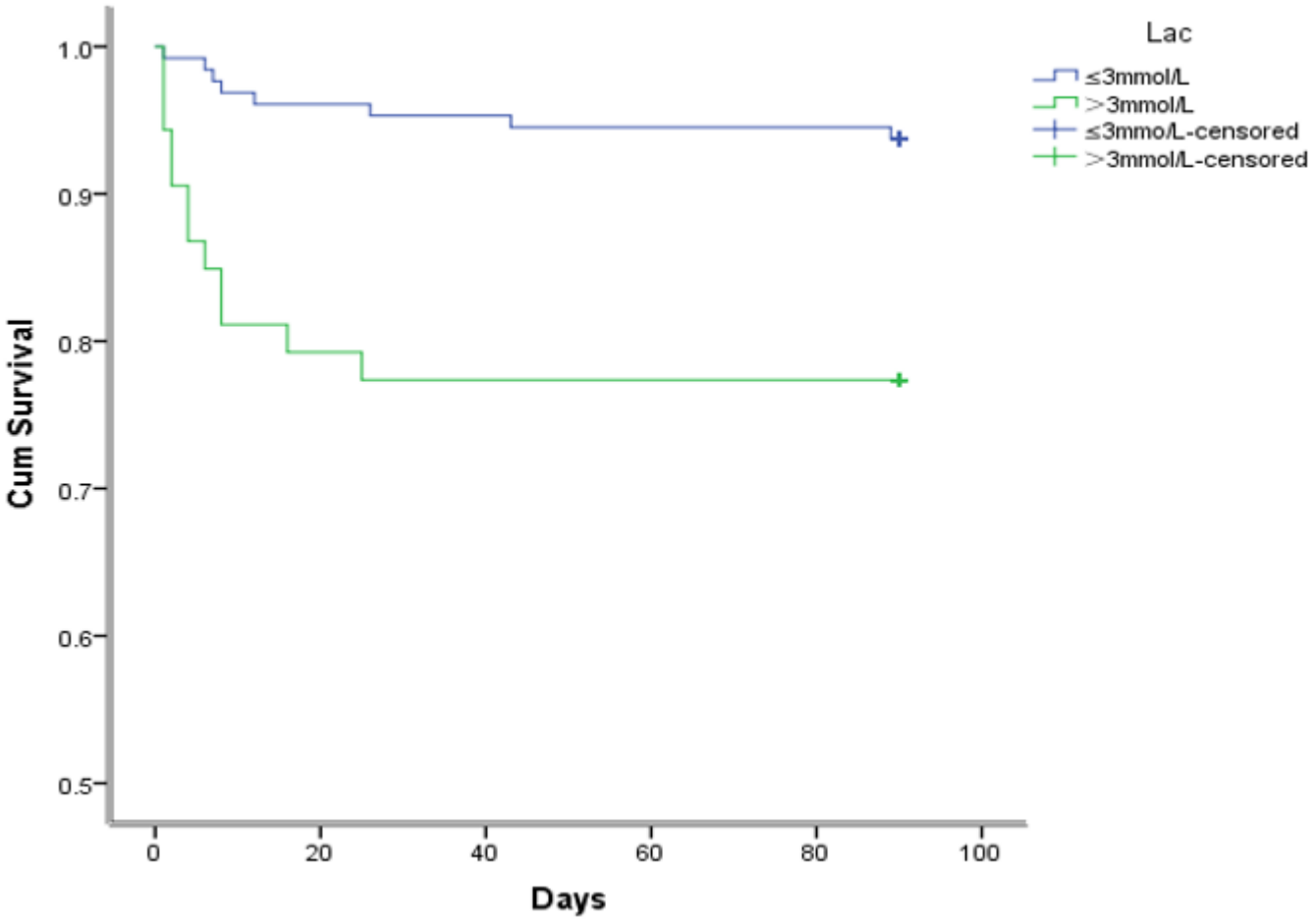


**Figure 2**

Kaplan-Meier survival curves of Lac on overall survival at 90 days

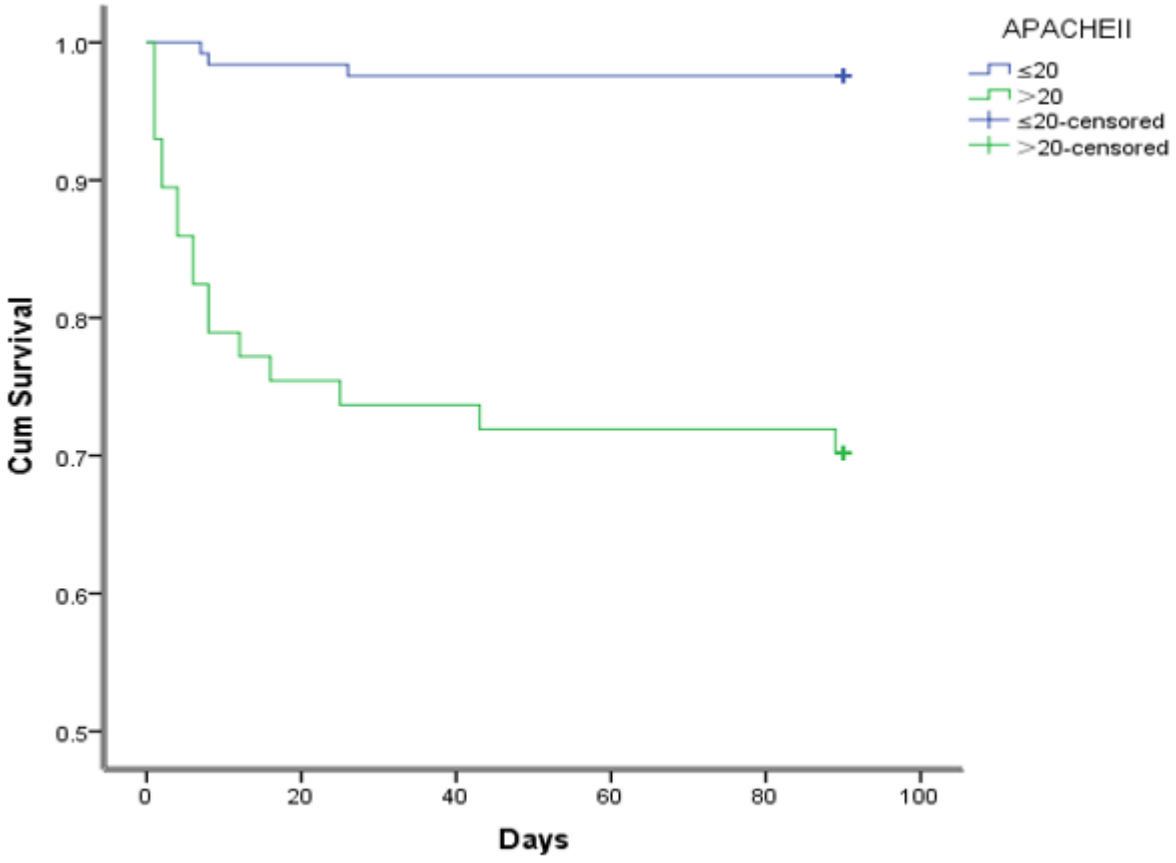


**Figure 3**

Kaplan-Meier survival curves of APACHE II score on overall survival at 90 days