นิพนธ์ต้นฉบับ

ปัจจัยที่เกี่ยวข้อง และสัดส่วนการรอดชีพของผู้ป่วยติดเชื้อในกระแสเลือดจากระยะเวลารอคอยในห้องฉุกเฉิน

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บทคัดย่อ

ที่มาของปัญหา: ผู้ป่วยติดเชื้อในกระแสเลือดเป็นผู้ป่วยกึ่งวิกฤตซึ่งผู้ป่วยกลุ่มนี้ถ้าไม่ได้รับการรักษาอย่างทันท่วงทีอัตราการเสียชีวิตก็จะสูงขึ้น ระยะเวลาการรอคอยในห้องฉุกเฉิน เป็นอุปสรรคต่อการให้การรักษาอย่างทันท่วงทีอย่างหนึ่ง

วัตถุประสงค์: เพื่อหาความสัมพันธ์ของระยะรอคอยในห้องฉุกเฉินที่มีผลต่อสัดส่วนการรอดชีพในผู้ป่วยที่ติดเชื้อในกระแสเลือดและปัจจัยที่เกี่ยวข้องต่อการรอดชีพ

วิธีการศึกษา: เป็นการศึกษาแบบย้อนหลัง (retrospective cohort study) กลุ่มตัวอย่างคือผู้ป่วยที่มีภาวะติดเชื้อในกระแสเลือดที่เข้ารับการรักษาจำนวน 318 ราย การวิจัยดำเนินการโดยศึกษาเปรียบเทียบอัตราการรอดชีวิตของผู้ป่วยติดเชื้อในกระแสเลือดระหว่างผู้ป่วยที่มีระยะการรอคอยในห้องฉุกเฉินที่ไม่เกิน 24 ชม. มากกว่า 24 แต่ไม่เกิน 72 ชม. เมื่อผู้ป่วยกลับบ้านและเมื่อครบ 30 วันข้อมูลที่ได้นำมาวิเคราะห์ทางสถิติเพื่อหาปัจจัยที่เกี่ยวข้องต่อสัดส่วนการรอดชีพโดยใช้ Logistic regression analysis

ผลการศึกษา: พบว่า ระยะรอคอยในห้องฉุกเฉินของผู้ป่วยแตกต่างกัน (24 ชม. มากกว่า 24 แต่ไม่เกิน 72 ชม. เมื่อออกจากโรงพยาบาล และเมื่อครบ 30 วัน) ไม่มีผลต่ออัตราการรอดชีวิตของผู้ป่วยที่มีภาวะติดเชื้อ อย่างมีนัยสำคัญทางสถิติ (p = 0.41, 0.72, 0.25 และ 0.11 ตามลำดับ) นอกจากนี้ พบว่า ปัจจัยอื่นที่มีผลต่อสัดส่วนการรอดชีพในผู้ป่วยติดเชื้อในกระแสเลือดอย่างมีนัยสำคัญทางสถิติ ได้แก่ ภาวะการล้มเหลวหลายระบบ (p < 0.001: Adjusted OR = 9.987: 95%CI 2.97 - 33.55) และการมีความดันโลหิตต่ำเนื่องจากการติดเชื้อ (p = 0.02: Adjusted OR = 4.1: 95%CI 1.24 - 13.54)

สรุป: ปัจจัยระยะรอคอยในห้องฉุกเฉินที่ต่างกันไม่มีผลต่ออัตราการรอดชีวิตของผู้ป่วยติดเชื้อในกระแสเลือด ปัจจัยอื่นๆ ที่มีผลต่อการรอดชีวิตของผู้ป่วย คือ ความดันโลหิตของผู้ป่วย และภาวะที่มีการล้มเหลวของหลายระบบของผู้ป่วย ซึ่งสามารถใช้ในการพยากรณ์อัตราการรอดชีวิตของผู้ป่วยติดเชื้อในกระแสเลือดได้

คำสำคัญ: ภาวะติดเชื้อในกระแสเลือด, อัตรารอด, ระยะรอคอยในห้องฉุกเฉิน, การดูแลภาวะฉุกเฉิน

ORIGINAL ARTICLE

The Association of Length of Stay in The Emergency Department and Survival Proportion among Sepsis Patients

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ABSTRACT

BACKGROUND : Patients with sepsis (bloodstream infections) are semi-critically ill patients, and without timely treatment their mortality rate will rise. One of the many factors that impede prompt treatment is the length of the waiting time in the emergency room. It is important to study whether the waiting period in the emergency room will affect the survival rate of patients with sepsis.

OBJECTIVES: To find the relationship between length of stay in the emergency department and the survival proportion among sepsis patients and other associated factors.

METHODS: This study is a retrospective cohort study which was from collected data among 318 patients with sepsis. By comparing the survival proportions of patients with sepsis with a waiting period in the emergency room of not more than 24 hours and more than 24 hours but not more than 72 hours when they returned home 30 days after admission, the data were analyzed statistically to determine the relationship.

RESULTS: The waiting times in the emergency room (24 hours, more than 24 hours but not more than 72 hours, when discharged 30 days after admission) did not affect the survival rate of the infected patients (p = 0.41, 0.72, 0.25 and 0.11). In addition, it was found that the multiple organ dysfunction or failure (p < 0.001: Adjusted OR = 9.987: 95%CI 2.97 - 33.55) and low blood pressure caused by sepsis (p = 0.02: Adjusted OR = 4.1: 95%CI 1.24 - 13.54) were significantly related to the survival proportion.

CONCLUSIONS: The waiting time in the emergency room did not affect the survival proportion of patients with sepsis. Factors to be considered for this group of patients because they affect the survival rate of patients with sepsis were the blood pressure and multi-system failure, which can both be used to predict the survival rate of patients with sepsis.

KEYWORDS: sepsis, survival rate, length of stay, emergency care

INTRODUCTION

Septicemia, or sepsis, is one of the important health issues in the world. Sepsis can be defined as bacteremia with potential organ dysfunction caused by a dysregulated host response to infection. The stage of organ dysfunction can be identified as an acute change in total sequential organ failure with an assessment score (SOFA score) of ≥2 points consequent to the infection.

The World Health Organization (WHO) reported that there are approximately 27,000,000 septic patients throughout the world each year, and one person dies from this every 3.5 seconds[1]. Incidence in Thailand was 75-150 septic patients per 100,000 or over 5,000-10,000 patients per year with the death rate of 62-73.9%[2] making it the third leading cause of death in Thailand following strokes and cancer[3-5].

From previous studies[6-7], it can be concluded that after using the qSOFA criteria the ICU admission rate and the 48-hour mortality classification are lower than using previous SIRS criteria. In Chumphae Hospital, Thailand there are 600-800 septic patients per year with a death rate of 4-6%. One of the critical issues is that many septic patients are unable to have access to medical service within the required timeframe because of time spent in the crowded emergency department. Overcrowding problems lead to medical errors, patients' dissatisfaction, and emotional stress among medical staff. Some previous studies found that septic patients were unable to have access to an efficient medical care service[8-11] in which 30-50% of deaths could be preventable[1].

In addition, Young et al.[12] demonstrated that the patients who had higher scores of APACHE II took a longer time in the emergency department and possibly had a higher risk of death (relative risk 3.5: 95%CI 1.4-9.5). Also, when the transfer of critically ill patients from a normal care unit to an intensive care unit took longer than 4 hours this could lead to a higher mortality rate of 20-65%, caused longer time in intensive care unit and higher cost of medical care. The results from several studies[8, 13-14] revealed the relationship between waiting time for medical service in the emergency department and survival rate. In Thailand, the better survival rate of the sepsis patients was achieved when the time to receive medical services became shorter[15-18]. However, there is currently no research that studies the effect of the waiting period in an emergency room to the survival rate of patients with sepsis. Thus, the outcome from this study not only will be fruitful to academia but will improve the medical care for patients with sepsis and will bring about positive change in the performance of emergency hospitalization and a consequent improved quality of life of the patients.

The primary objective of this study is to predict the survival proportion in septic patients according to the waiting time in the emergency department, while the secondary objective is to investigate other influential factors that may be relevant to the survival proportion in septic patients in the emergency department.

The purpose of the present study was to find the relationship between length of stay in the emergency department and survival proportion among sepsis patients and other factors that associated.

METHODS

Research Design

This retrospective cohort study design was done as part of a logistic regression analysis to analyze the expected duration of time until death in patients with sepsis with a different waiting period in

the emergency room. Data of septic patients who received medical service in the Emergency Department of Chumphae Hospital, Thailand from 1st May, 2016 to 30th April, 2017 were collected. The medical records of patients with septicemia receiving medical treatment in the Emergency Department of Chumphae Hospital were reviewed. The data of the patients were triaged as septic or non-septic. These data were then measured for statistical relationships. The ethical approval for this research was given by the Research Ethics Subcommittee of Chumphae Hospital No HE631006/2563.

Population and Sampling

Data were collected from the medical records of approximately 334 septic patients (with an all risk level or all qSOFA score) with inclusion criteria which included: 1) Patient with septicemia and 2) Patient aged 18 and over. Additionally, exclusion criteria included: 1) Pregnant patient, 2) Patient with cardiac arrest, and 3) Patient who was unwilling to receive medical treatment. From the medical record review, Chumphae Hospital has 600-800 septic patients per year with a death rate of 4-6%. So, the minimum sample size was calculated from the estimated finite population proportion by the equation, as follows.

$$n = \frac{Np(1-p)z^2_{1-\frac{\alpha}{2}}}{d^2(N-1)+p(1-p)z^2_{1-\frac{\alpha}{2}}}$$

For a population (N) of 600 septic patients with error (d) at 5%, and the proportion (p) of the death rate at 6%. The criteria was at $\alpha = 0.05$ hence the researcher calculated the minimum sample size of at least 229 patients to be recruited into this study. Finally, a total of 318 samples was included.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS) version 17 was the software used for data analysis. The descriptive statistics including the mean, median, standard deviation and percentage distribution were used for the quantitative type of variable. For the qualitative type of variables, the percent and mode were used. Inferential statistics were performed to determine the relationship between the length of stay in the emergency department and the survival proportion among sepsis patients and other associated factors. The logistic regression was selected and the statistical significance was defined as $p < 0.05$.

RESULTS

The sample of 318 patients was classified into 157 male patients (49%) and the average age of the sample was 59.7 ± 19.3 years. Some underlying diseases were found in the sample; 109 people had hypertension (34%), 87 people had diabetes (27%), and 55 people had chronic kidney disease (17%). The greater number of the patients or 151 people (48%) came to receive medical service at the hospital during the morning shift (8.00 a.m. – 04.00 p.m.) and most of the patients (69%) came to the hospital by private vehicle followed by basic life support unit and an advanced life support unit (43% and 8%, respectively).

Categorized by infection system, the greater number of patients had respiratory tract infection (45%) followed by those with urinary tract infection (20%) and systemic infection (18%), as presented in Table 1.

Table 1 General Information on the Patients

Population Characteristics	Population Size (n = 318) (%)	qSOFA score** (n = 318) (%)	
		<2	≥2
Sex			
Male	157 (49)	118 (37)	39 (12)
Female	161 (51)	128 (40)	33 (11)
Average Age (years)	59.7±19.3	59.7±19.4	59.66±19.38
Underlying Disease			
Hypertension	109 (34)	85 (27)	24 (7)
Diabetes	87 (27)	70 (22)	17 (5)
Chronic kidney disease	55 (17)	42 (13)	13 (4)
Period of Arrival at the Hospital			
Morning shift	151 (48)	110 (35)	41 (13)
Evening shift	124 (38)	101 (32)	23 (7)
Night shift	43 (14)	35 (11)	8 (3)
Patient Transfer			
By advanced life support unit	24 (8)	16 (5)	8 (3)
By basic life support unit	74 (23)	58 (18)	16 (5)
By a private vehicle	220 (69)	172 (54)	48 (15)
Infectious System*			
Respiratory tract infection	141 (45)	107 (34)	34 (11)
Urinary tract infection	64 (20)	48 (15)	16 (5)
Systemic infection	58 (18)	46 (14)	12 (4)
Gastrointestinal tract infection	49 (15)	40 (13)	9 (3)
Other systems (nervous system, connective tissue, and cardiovascular system)	6 (2)	5 (1)	1 (1)

(*For infectious system patients count, count each person who has only one affected organ and not another., **qSOFA score = Quick sequential organ failure assessment identifies patients with suspected infection who are at high risk for in-hospital mortality outside of the intensive care unit.)

Table 2 shows that there is no statistical difference in the 24 and 72-hour and 30-day survival proportion and the day out of the hospital compared to the waiting time in the emergency department (p = 0.41, 0.72, 0.25, and 0.11, respectively).

Table 2 Waiting Time in the Emergency Department Compared with Survival Proportion.

Time	Survivors	Non-Survivors	*p* - value
24 hours			
Number (persons)	314	4	0.41
Median Time(minutes)	119.5 (90.8-168.5)	148.5 (110.8-178.8)	
72 hours			
Number (persons)	306	12	0.72
Median Time (minutes)	119.5 (90.8-170.0)	132 (105.5-166.3)	
Discharge			
Number (persons)	303	15	0.11
Median Time (minutes)	119 (90.0-167.0)	150 (107.0-170.0)	
30 days			
Number (persons)	284	34	0.25
Median Time (minutes)	118 (90.0-167.8)	130 (106.5-170.0)	

The Table 3 demonstrates the relationship between factors on the survival proportion among the 318 sepsis patients. Age, multiple organ dysfunction or failure, low blood pressure caused by sepsis and the qSOFA score were significantly related to the survival proportion of sepsis patients. It could be explained that the risk of having an older age had a 1.04 times greater chance of death per year increase in the age of sepsis patients (95% CI of crude OR: 1.00 - 1.07). Sepsis patients with multiple organ dysfunction or failure have 13.85 times greater chance of death (95% CI of crude OR: 4.52 - 42.49). Among those patients with low blood pressure caused by sepsis there is 4.94 times greater chance of death (95% CI of crude OR: 1.66 - 14.71). In addition, the odds for those who have a qSOFA score lower than 2 was 4.23 times greater than those who have qSOFA score more than or equal to 2 (95% CI of crude OR: 1.49-12.21).

However, statistical survival is not influenced by some factors, namely sex ($p = 0.83$), a congenital disease ($p = 0.94$), the time period of arriving at the hospital during 24 hours ($p = 0.06$), patient transfer ($p = 0.15$, 0.73), the need for oxygen consumption ($p = 0.15$) and waiting time in the Emergency Department ($p = 0.20$).

Table 3 Factors associated with survival proportion among 318 sepsis patients by using univariable logistic regression analysis.

Factors	Survivors	Non-survivors	Crude OR	95% CI of OR		*p* - value
				Lower	Upper	
Age (Mean ± SD)	59.2 ± 19.4	69.9 ± 16.2	1.04	1.00	1.07	0.04
Male Sex *	150	7	1			
Female Sex	153	8	1.12	0.40	3.17	0.83
Underlying disease						
No*	124	6	1			
Yes	179	9	1.04	0.36	2.99	0.94
Period of Arrival at the Hospital						
Morning shift*	141	10	1			
Evening shift	122	2	0.23	0.05	1.08	0.06
Night shift	40	3	1.06	0.28	4.03	0.93
Patient Transfer						
Private vehicle*	207	13	1			
Basic life support unit	73	1	0.22	0.03	1.70	0.15
Advanced life support unit	23	1	0.69	0.09	5.53	0.73
Consciousness						
A (Alert)*	280	10	1			
V (Voice)	17	4	6.46	1.59	26.33	0.009
P (Pain)	3	0	0	0		0.99
U (Unconscious)	3	1	9.33	0.89	97.81	0.06
Need for oxygen consumption						
No*	73	1	1			
Yes	230	14	4.44	0.57	34.37	0.153
Multiple dysfunction or failure						
No*	285	8	1			
Yes	18	7	13.85	4.52	42.49	< 0.001
Low blood pressure caused by sepsis						
No*	267	9	1			
Yes	36	6	4.94	1.66	14.71	0.004
qSOFA Score						
<2*	239	7	1			
≥2	64	8	4.27	1.49	12.21	0.007
Waiting Time in the Emergency Department						
<2 hr*	153	5	1			
≥2 hr	150	10	2.04	0.68	6.11	0.20

*Reference group

For controlling the confounding factors, the multivariable analysis which was shown in Table 4 can be used. The result reported that the multiple organ dysfunction or failure, and low blood pressure caused by sepsis were significantly related to the survival proportion at $p < 0.001$ and 0.02, respectively. Patients with multiple organ dysfunction or failure have 9.99 times greater chance of death when other controlling variables are constant (95% CI of adjusted OR: 2.97 - 33.55). Those patients with low blood pressure caused by sepsis have 4.1 times greater chance of death when other controlling variables are constant (95% CI of adjusted OR: 1.24 - 13.54).

Table 4 Factors associated with survival proportion among 318 participants by using multivariable logistic regression analysis.

Factors	Adjusted OR	95% CI of OR		*p* - value
		Lower	Upper	
Multiple dysfunction or failure				
No*	1			
Yes	9.99	2.97	33.55	< 0.001
Low blood pressure caused by sepsis				
No*	1			
Yes	4.1	1.24	13.54	0.02

*Reference group, **Adjusted variables included Age, Sex, Underlying disease, Period of Arrival at the Hospital, Patient Transfer, Consciousness, Need for oxygen consumption, Multiple organ dysfunction or failure, Low blood pressure caused by sepsis, qSOFA Score, and waiting Time in the Emergency Department by using Forward stepwise method.

DISCUSSION

This research investigated 318 septic patients in the Emergency Department of Chumphae Hospital, Thailand from 1st May, 2016 to 30th April, 2017. The results revealed that the patients' survival rate was 89.3% which was higher than the rate in the study of Tusgul et al.[6]. When comparing the qSOFA scores, the patients in this study had a higher survival rate than the study of Tusgul et al.[6], which was 40% for the 48-hour survival rate.

The waiting time in the emergency department of this study is similar to the previous studies of Yoon et al.[13] and Chaou et al.[1,14] which was 2-5 hours. The reason why the patients take a longer time in the emergency department is that they had to wait to see a doctor as well as for a laboratory test, diagnostic radiology, and transfer to a medical specialist for counseling. However, a statistical difference between survivors and non-survivors was not found; the median of the waiting time was 119 minutes (90.0-167.0 minutes) and 150 minutes (107.0-170.0 minutes), respectively.

Factors influencing the patients' survival proportion, i.e. consciousness, blood pressure, and multiple organ dysfunction or failure were considered to develop the qSOFA for primary assessment of patients in order that they could be treated in time. The study of García-Gigorro et al.[2] found that patients who were older and had higher APACHE II scores would take a longer time in the emergency department and have a higher mortality risk. Therefore, providing treatment for patients in time is extremely important in terms of effective medical care[15]

Considering the non-survivors, they were in the emergency department for a slightly longer time than the survivors. As a result, taking either a longer or shorter time in the emergency department did not influence the patients' survival rate, which corresponds to the findings previously discussed in the literature review section based on García-Gigorro et al.[2] and Young et al.[12]. In other words, providing a correct and quick assessment and care service can help more patients survive.

For the limitation of this study, since this is a retrospective observational study, the limitation for research of this kind can derive from a bias occurring in data collection. Therefore, collecting additional data on other related factors is suggested, such as examining whether patients are treated according to the guidelines in health care practice, assessing patients when being admitted, complications during hospitalization, the number of days spent in the

hospital, etc., so that these data will be useful for patient care improvement.

Lastly, the contribution of this study is that the findings can be further developed as practice guidelines for care of septic patients every time they are admitted and the implementation of the guidelines may be further extended to patients with other complications as well.

Conflicts of Interest: None

Financial Support: None

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