Original Research

Faktor Dominan dalam Memprediksi Mortalitas Pasien dengan Sepsis di Unit Gawat Darurat

The Dominant Factor to Predict Mortality on Patient with Sepsis in Emergency Department

Ilham Akbar¹, Edi Widjajanto², Mukhamad Fathoni³

¹Program Studi Magister Keperawatan Fakultas Kedokteran Universitas Brawijaya Malang

²Laboratorium Patologi Klinik Fakultas Kedokteran Universitas Brawijaya Malang

³Departemen Keperawatan Fakultas Kedokteran Universitas Brawijaya Malang

ABSTRAK

Mortalitas pasien dengan sepsis meningkat secara drastis dengan tingkat keparahannya. Ada banyak faktor yang yang menjadi pertanda perburukan kondisi maupun kematian pasien dengan sepsis. Seorang perawat diharapkan dapat menjadi lini terdepan di unit gawat darurat untuk dapat memprediksi mortalitas pasien dengan sepsis untuk menentukan tindakan definitif dengan segera tanpa melakukan pemeriksaan laboratorium. Tujuan penelitian yaitu menganalisis faktor dominan yang berhubungan dengan mortalitas pasien dengan sepsis. Penelitian kuantitatif ini menggunakan desain observasi analitik dengan pendekatan retrospektif. Sampel menggunakan rekam medis pasien dengan sepsis disesuaikan dengan kriteria inklusi dan ekslusi dan ditentukan dengan teknik *consecutive sampling* yaitu sebanyak 75 responden. Analisis bivariat yang dilakukan pada penelitian ini menggunakan kontigensi lambda dan *chi square*, sedangkan analisis multivariat menggunakan regresi logistik. Hasil uji bivariat menunjukkan bahwa usia (r=0,305, p=0,030), nilai qSOFA (r=0,678, p=0,000), dan penyakit komorbid (r=0,243, p=0,030) masing-masing memiliki arah hubungan positif dengan mortalitas pasien sepsis (OR=7,000, p=0,016). Penyakit komorbid dan nilai qSOFA adalah faktor yang dapat mempredikisi mortalitas pasien sepsis namun penyakit komorbid merupakan faktor yang paling dominan.

Kata Kunci: Mortalitas, nilai qSOFA, penyakit komorbid, sepsis, usia

ABSTRACT

A The mortality of patients with sepsis increases dramatically parallel with their severity. There are many factors that sign the worsening conditions and death of patients with sepsis. A nurse is expected to be the front line in the emergency unit to be capable to predict the mortality of patients with sepsis to determine definitive measures immediately without conducting laboratory tests. This research objective was to analyze the dominant factors associated with mortality of patients with sepsis. This quantitative research used analytic observation design with a retrospective approach. Samples were medical records of patients with sepsis adjusted to the inclusion and exclusion criteria and were determined by consecutive sampling technique as many as 75 respondents. Bivariate analysis conducted in this study used lambda and chi square contingencies, while multivariate analysis used logistic regression. The bivariate test results show that age (r=0.305, p=0.030), qSOFA value (r=0.678, p=0.000), and comorbid disease (r=0.243, p=0.030) each has a positive relationship with sepsis patient mortality. The results of logistic regression show that comorbid disease increases 6.6 times the mortality in septic patients (OR=7.000, p=0.016). Comorbid disease and qSOFA values are factors that can predict mortality in septic patients, but comorbid disease is the most dominant factor.

Keywords: Age, comorbid disease, qSOFA score, Sepsis, mortality

Corresponding Author: Ilham Akbar. Program Studi Magister Keperawatan Fakultas Kedokteran Universitas Brawijaya Malang. Jl. Veteran Malang 65145 Tel. 085755002629 Email: knightakuba@gmail.com

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INTRODUCTION

Sepsis is a life-threatening organ dysfunction as a result of an infection response and causes regulatory failure in patients (1) in a high incidence. The recorded global incidence in the relevant hospitals showed sepsis treatment as many as 437 (with 17% mortality) and 270 cases of severe sepsis (with 26% mortality) per 100,000 people per year (2). The annual incidence of sepsis that occurs globally reaches 31.5 million cases, with 19.4 million cases of being severe sepsis, and causes 5.3 million of deaths (3).

Earlier identification and treatment in patients with sepsis has been shown to reduce mortality because it can shorten the diagnosing time and reduce patient mortality from sepsis with organ dysfunction (4,5). Therefore an appropriate scoring system will be a major step in reducing mortality in septic patients. Several scoring systems have been made to facilitate medical personnel in estimating the extent of organ damage, one of which is a quick Sequential Organ Failure Assessment (qSOFA) that has been clarified by sepsis-3 task force as scoring system used to predict organ failure and patient death (6). The quick Sequential Organ Failure Assessment (qSOFA) value emerged as a tool to identify septic patients with a high risk of short-term mortality in terms of preliminary observations made in the emergency department. The target for determining the qSOFA score is very easy to apply by bedside and uses 3 clinical criteria with 1 point each if the characteristics appear, which include RR \geq 22x/m, systolic blood pressure \leq 100 mmHg, and changes in consciousness level or GCS score less than 15, using scoring criteria of 0 for low mortality prediction and 3 for high mortality prediction (7).

The qSOFA scoring system is equally effective and accurate in predicting patient mortality compared to its former scoring system, SOFA in septic and non-septic patients. In terms of efficiency, qSOFA is recommended because it is easy to apply and does not require laboratory tests (8). The use of qSOFA in emergencies is very important because qSOFA as a risk assessment tool is more specific to patient mortality than its predecessor (SIRS) (9).

Patient age is one of the factors associated with mortality of patients with sepsis in line with the fact that most sepsis is dominated by patients aged 65 to 84 years with a percentage reaching 49% (10). Age plays a role in the mortality of septic patients in intrahospital settings. As age increases, the maximum percentage of mortality in patients with sepsis reaches 36.5% while the mortality of severe septic patients reaches 60.3%. From these data it can be concluded that age is one of the factors associated with mortality in septic patients (3).

Besides age, comorbid diseases are another factor that plays a role in the death of patients with sepsis. Chronic obstruction pulmonary disease (COPD) is one of the diseases that can cause failure of respiratory function especially in patients with sepsis. Patients with COPD will induce not only lung function failure but also the heart and other organs (11). In addition to diseases associated with respiratory obstruction, patients with end stage of renal disease who undergo hemodialysis are susceptible to sepsis or infection. From the 7-year follow up data, sepsis condition was found in 11.7% of patients with hemodialysis and 9.4% of patients with peritoneal dialysis. This is related to the repetitive exposure of patients undergoing hemodialysis with an invasive procedure that allows to become *port de entry* of microorganisms to enter (4). In the Surviving Sepsis Campaign in 2012, it was stated that controlling plasma glucose is one of the ways that have to be done to maximize the effects of other sepsis therapies. Intravenous glucose <180 mg/dL is vital in the management of patients with sepsis (12).

The Emergency Department of Jombang Hospital, dated since July 2017, has indicated that the sepsis diagnosis (caused by gram negative bacteria) was ranked 4th from the top 10 diseases in the emergency department with a total of 52 patients (38 new cases and 14 old cases). The total number of septic patients in February-November 2017 was amounted to 257, with the characteristics of septic patients over 20 years of age as many as 242 patients (94%). Of the total patients, 79 people (30.7%) died and 163 patients (63.4%) went home forcibly or recovered. It is important to recognize the factors related to mortality of patients with sepsis because the actions implemented to save the lives of patients must be fast and appropriate especially because in patients with sepsis dysfunction occurs in some organs. This study aimed to analyze the most dominant factors of the qSOFA score as well as the age and comorbid factors associated with mortality of patients with sepsis.

METHOD

The design of this study was observational analytic using secondary data. The study was conducted in the medical record room at Jombang General Hospital in January-March 2018. The research instruments used in this study were record sheets for data variables on ages, qSOFA values, and comorbid diseases. Data on patient mortality variables were based on death certificates attached on the patient's medical record. This research has received permission from the Ethics Commission of Universitas Brawijaya (No.433/EC/KEPK-S2/12/2017).

The population in this study were patients treated at Jombang General Hospital in the period of 2017-2018, which included medical records of septic patients who administered through the Emergency Department. The research sample that was 75 medical records has been calculated using the rule of thumb that the number of the minimum sample size was 10 times the number of independent variables examined in multivariate research (13). Sampling was done by consecutive sampling technique with inclusion criteria that were above 25 years old, qSOFA values including RR $\geq 22x/m$, systolic blood pressure ≤100 mmHg, and GCS score changes <15, medical records containing the required data including age, and history of accompanying comorbidity. Data were not included as a sample if the patient was moved to other hospital before 3 days of treatment.

The dependent variable in this study was the outcome of

the patient, i.e. alive or died, and using age, qSOFA score, and comorbid disease as the independent variables. Besides, patient demographic data were also collected. The patient age and the qSOFA score were managed using ordinal scale while comorbid and mortality diseases were on nominal scale. Bivariate analysis was using lambda contingency test and chi square (<0.05) to test the correlation of each factor to the mortality of patients with sepsis. Multivariate analysis was using logistic regression analysis to find out the most dominant factor related to mortality of septic patients in Emergency Department.

RESULTS

Table 1 shows that the majority of respondents were male, as many as 40 people (53%). Looking at the history of formal education, most of the respondents as many as 46 people (61%) finished elementary school education, and most of the respondents as many as 25 people (33%) were self-employed.

Table 1. General characteristics of respondents

Characteristic		Ν	%
Gender of respondent	Male	40	53%
	Female	35	47%
	Total	75	100%
Education level of respondent	respondent Did not attend school		12%
	Elementary school	46	61%
	Junior High School	7	9%
	Senior High School	9	12%
	Higher Education	4	6%
	Total	75	100%
Occupation of respondent	Unemployed	3	4%
	Housewife	23	31%
	Self-employed	25	33%
	Farmer	15	20%
	Civil Servant	4	5%
	Retired	5	7%
	Total	75	100%

Table 2 shows that most were aged 65-84 years, and 29 people (39%) were \geq 85 years, 24 people (32%) had 3

points qSOFA score. In the detailed characteristics of the qSOFA value, from 75 respondents 43 people (57%) were found to have respiratory frequency $\geq 22x/m$, 47 people (62%) had systolic blood pressure ≤ 100 mmHg, and 41 people (55%) had GCS scores less than 15. A total of 44 people (59%) came with comorbid disease, and the majority of patients as many as 39 people (52%) died. Of the 75 respondents, the most common comorbid disease in septic patients were 19 findings (25%) on kidney failure, 18 findings (24%) on diabetes, 4 findings (5%) on stroke, and 3 people (4%) on heart disease.

Table 2. Characteristics based on variables

Varia	N	%	-	
Age of respondent	25-64 years	17	22%	
	65-84 years	29	39%	
	=85 years	29	39%	
	Total	75	100%	
qSOFA Score/Value	Score 0	12	16%	
	Score 1	22	29%	
	Score 2	17	23%	
	Score 3	24	32%	
	Total	75	100%	
Indicator on qSOFA	RR = 22x/m	43	57%	
	SBP = 100 mmHg	47	62%	
	GCS score < 15	41	55%	
Comorbid disease	No	31	41%	
	Yes	44	59%	
	Total	75	100%	
Kind of Disease	Kidney failure	19	25%	
	Diabetes	18	24%	
	Stroke	4	5%	
	Heart disease	3	4%	
Mortality Status	Alive	36	48%	
	Died	39	52%	
	Total	75	100%	

The bivariate test results showed that the patients' age (r = 0.305, p = 0.030), qSOFA value (r = 0.678, p = 0,000), comorbid disease (r = 0.245, p = 0.030) had a positive correlation with the mortality of patients with sepsis (Table 3).

				Mortalit	y of patient				
Independent	: Variable	Alive		Died		Total		R	р
		N	%	n	%	n	%		
Age	25-64 years	12	16	5	7	17	22		
	65-84 years	15	20	14	19	29	39	0.205	0.000
	>85 years	9	12	20	26	29	39	0,305	0,030
	Total					75	100		
qSOFA score	Score 0	11	15	1	1	12	16		
	Score 1	18	24	4	5	22	29		
	Score 2	5	7	12	16	17	23	0,678	0,000
	Score 3	2	3	22	29	24	32		
	Total					75	100		
Comorbid Disease	Yes	16	21	27	36	43	58		
	No	20	27	12	16	32	42	0,243	0,030
	Total					75	100		

Table 3. Analysis of the correlation of age, qSOFA score, comorbidity, and mortality in septic patients

Maniahla	Coefficient ß Wald P Value C	14/-1-1	D.Value	0.0	95% Confidence Interval		
variable		UK	Lower Bound	Upper Bound	Square		
Age		3,077	0,215				0,666
Age (1)	-0,995	1,115	0,291	0,370	0,58	2,345	
Age (2)	-1,432	2,935	0,087	0,239	0,046	1,229	
Comorbid	1,946	5,851	0,016	7,000	1,447	33,871	
qSOFA		22,175	0,000				
qSOFA (1)	-5,405	14,382	0,000	0,004	0,000	0,073	
qSOFA (2)	-4,257	15,833	0,000	0,014	0,002	0,115	
qSOFA (3)	-1,694	2,785	0,095	0,184	0,025	1,344	
Constant	2,267	5,806	0,016	9,650			

Table 4. Multivariate analysis of logistic regression tests

Logistic regression test showed that comorbid disease factors (OR = 7,000, p = 0.016) were the dominant factors associated with mortality of patients in the Emergency Department of Jombang Hospital. The percentage of the independent variables (age, qSOFA value and comorbid disease) influence on the dependent variable (mortality of patients with sepsis) was 66.6%, while the remaining 33.4% was influenced by other variables not included or discussed in this study. The equations that could be obtained in predicting mortality in patients with sepsis are as follows: y = 2.267-5.405(qSOFA 1)-4.257(qSOFA2)+1.946 (comorbid). If the probability is calculated by the formula p = 1/(1 + exp(-y)) then the value of 0.90522 is found. This means that patients with positive qSOFA with comorbid disease will have a mortality of 90.5%.

DISCUSSION

The results showed that the qSOFA score and comorbid disease act as factors that could predict the mortality of septic patients in the emergency department at Jombang General Hospital. The probability of the equation built shows that patients with higher qSOFA values , and if having comorbid diseases, will have even higher mortality risk.

The qSOFA value is very influential in the mortality of septic patients. The higher the score, the higher the mortality. The components of the qSOFA measurement are divided into 3 domains, namely GCS, SBP and RR. GCS is a reliable measuring tool that can universally measure a person's level of consciousness. GCS scores can measure responses of eye, motor, and verbal given in a range between 0-15, so the extent to which the brain experiences problems can be identified (14). GCS is considered important because the assessment using GCS is believed to be able to predict the development of a patient's condition (15). Another study also mentioned that GCS is one of the measurements used to predict discharge status (alive or died) from the hospital (16).

The abnormality of systolic blood pressure will increase the mortality risk of patients over 50 years old. In septic conditions that are interpreted by organ failure and cardiac arrest can occur in patients with septic shock and hypotension. This is due to the absence of cardiac output, so the use of inotropic therapy is very important for increasing the pulse and the work of heart pump (17, 18). The 2012 Surviving Sepsis Campaign Guidelines also states that vasopressor therapy is vital in patients with sepsis, from the study it was explained that in septic patients and septic shock, vasopressors will play a role to restore hypotension and restore intravascular volume, so blood flow to the brain becomes smooth. In a decreased blood pressure, the blood flow to the brain will be hampered and experience a lack of oxygen (12).

Breath frequency is one assessment component which is a good predictor for determining the mortality of septic patients. On the qSOFA measurement scale by Arbiyantara et al, it was stated that in the logistic regression analysis, it turned out that respiratory frequency was one component of assessment which significantly affected mortality in septic patients compared to other variables (9). This is supported by a study that states that the inaccuracy of the Surviving Sepsis Campaign (SSC) implementation, especially related to the availability of mechanical ventilation and the adequacy of calories in the first 48 hours, will increase mortality risk (19).

Patients with sepsis who have comorbid diseases will increase the risk of mortality compared with patients who do not have comorbidities. Clinical data in Table 2 states that comorbid diseases that are suffered by many septic patients are kidney disease. Septic patients who experience chronic kidney failure or patients with dialysis will have weaker vital signs and trigger organ failure (4). Also, influential comorbid disease according to Table 2 after kidney failure is diabetes. Septic patients with hyperglycemic conditions will cause metabolic problems that can affect patient mortality. In a study, it was stated that long-term chronic hyperglycemia conditions can trigger organ failure, especially kidneys, nerves, eyes, heart, and blood vessels, and have 17 times higher risk of organ damage compared to patients who do not have diabetes (20,21).

The age factor in the logistic regression test above only acts as a confounding variable even though the bivariate test results prove to be related. Theoretically, the older the patient is, the more likely the patient will die. This is in line with the results of a study conducted by Epstein et al. that stated mortality in septic patients suffered the most was at the age of 65 years (6). The statement was strengthened by research which stated that it is certain that there were around 400,000 patients with infections who came to hospitals with an age range of 45 years and above with increasing mortality (22). From several references above, it can be concluded that age is related to the mortality of septic patients, patients who reach adulthood-elderly are more vulnerable compared to the younger age.

Ages, qSOFA value, and comorbid disease factors are associated with mortality in septic patients with qSOFA and comorbid diseases as the dominant predictor factors.

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Early recognition of high mortality potential in septic patients, namely the presence of comorbidities and qSOFA scores, can be the basis for health workers in determining actions to prevent more quickly and precisely. Prospective cohort studies up to the post hospital phase, because not all patients undergo full care at the hospital, need to be done to improve the accuracy of predictive studies on outcomes of septic patients.

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