The Predictors of Mortality among Critically Ill Patients in Emergency Department, dr. Cipto Mangunkusumo Hospital

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Abstract

Identifying the severity of patient's condition is very important to be done in emergency department. The severity can be predicted by assessing vital signs of patients. Factors and scoring system in predicting mortality of critically ill patients in Indonesia remain unclear. We aimed to evaluate vital signs as predictors of mortality and determine whether Modified Early Warning Score (MEWS) can be used to predict mortality among Indonesian patients. We conducted a retrospective study of all patients admitted to the dr. Cipto Mangunkusumo Hospital's emergency department (ED) from January-December 2011. Physiological parameters including consciousness, heart rate, respiratory rate, and blood pressure were obtained from medical records. MEWS were calculated from the data and non-parametric test was performed to identify predictors of 30-days mortality. Total of 579 patients were registered. The most common indication at admission was decrease in level of consciousness. Abnormal vital signs were associated with the increased odds of death. Patients with bradypnea were the most likely to die compared to the other factors (OR 48.405; 95%CI 6.28-373.12). The odds of death for in patient increased significantly as the MEWS increased >4 (OR 3.815; 95% CI 2.70-5.40). Decrease in level of consciousness, abnormal heart rate, abnormal respiratory rate, and MEWS >4 increase the odds of death among critically ill patients in ED
Keywords: *predictors, death, critically ill patients, emergency department, MEWS*

Prediktor Kematian pada Pasien Kritis di Instalasi Gawat Darurat RS dr. Cipto Mangunkusumo

Abstrak

Identifikasi severitas kondisi pasien sangat penting dilakukan di Instalasi Gawat Darurat (IGD). Tingkat severitas dapat diprediksi dengan menilai tanda vital pasien. Faktor dan sistem skoring prediktor mortalitas pasien kritis di Indonesia belum jelas. Penelitian ini bertujuan mengevaluasi tanda vital sebagai predictor mortalitas dan menentukan apakah skoring *Modified Early Warning Score* (MEWS) dapat digunakan untuk memprediksi mortalitas pasien di Indonesia. Penelitian dilakukan retrospektif dengan subjek semua pasien yang dirawat di IGD RS dr. Cipto Mangunkusumo (RSCM) pada 1 Januari-31 Desember 2011. Tingkat kesadaran, frekuensi nadi, frekuensi napas, dan tekanan darah didapatkan dari rekam medis. MEWS dihitung dan tes non-parametrik dilakukan untuk mengidentifikasi prediktor kematian 30 hari. Sebanyak 579 pasien menjadi subjek. Indikasi rawat inap tersering adalah penurunan kesadaran.Tanda vital abnormal diasosiasikan dengan peningkatan angka kematian. Bradipnea menjadi prediktor kematian utama dibanding faktor yang lain (OR 48.405; 95%CI 6.28-373.12). Angka kematian pasien rawat inap meningkat bila nilai MEWS >4 (OR 3.815; 95% CI 2.70-5.40). Penurunan kesadaran, frekuensi nadi dan napas abnormal, dan MEWS >4 meningkatkan angka kematian pasien kritis di IGD.
Kata kunci: prediktor, kematian, pasien kritis, gawat darurat, MEWS

Introduction

Emergency department (ED) received patients from minor condition to critical one. Critical patients need intensive and immediate treatment. The recognition of life threatening condition is very important to formulate treatment in emergency setting.[1] Ideally, emergency physicians should be able to recognize the illness severity and the need for urgent attention minutes from admission.[2] According to studies conducted in various countries, abnormal vital signs during admission can predict critically ill patients's mortality during hospitalization.[2,3]

Various scoring systems based on vital signs have been proposed to assessed patients risk in ED. These scoring help physicians to sort more severe patients who need immediate care and treatment.[4,5] The modified early warning score (MEWS) is a scoring tools that's been used widely and based on physiological parame-ters, such as heart rate (HR), respi-ratory rate (RR), systolic blood pressure (SBP), temperature, and level of conciousness. MEWS is a simple tool to identify the severity of patients which can be used in emergency setting. High MEWS score is associated with increased mortality. According to Hock *et al*, MEWS score can predict patient's poor outcomes.[5]

In Indonesia, data about mortality predicting factors and scoring for critically ill patients remain unclear. Therefore, this study was conducted to assess vital signs as mortality predictors in critically ill patients and whether MEWS is applicable for Indonesian patients.

Methods

We retrospectively evaluate all admitted patients in Dr. Cipto Mangunkusumo Hospital's (RSCM) ED, January to December 2011. This study excluded patients who were younger than 19 years old, had incomplete data, or had death on arrival (DOA). Patients' data were obtained from medical records and ED recapitulation book. Demographic characteristics, admission indication, vital signs when admitted, diagnosis, treatment, and outcomes within 30 days were evaluated.

RR was classified as normal (12-20x/min), tachypnea (>20x/min), and bradypnea (<12x/min); HR was classified as normal (60-100 bpm), tachycardia (>100 bpm), and bradycardia (<60 bpm); and blood pressure was classified as normal (SBP 91-139 mm Hg), hypertension (SBP>140 mmHg), and hypotension (SBP <90 mmHg). Level of consciousness were assessed using alert, verbal, pain, and unresponsive (AVPU). MEWS score was classified into <4 and >4.

Non parametric tests were used to compare patients' outcome and vital signs (consciousness, RR, HR, blood pressure and MEWS). Odds ratios (OR) of vital signs when admitted to in hospital mortality were assessed. Logistic regression was performed to test the association of in hospital mortality with MEWS and vital signs. Statistical analysis was performed using SPSS version 20.0.
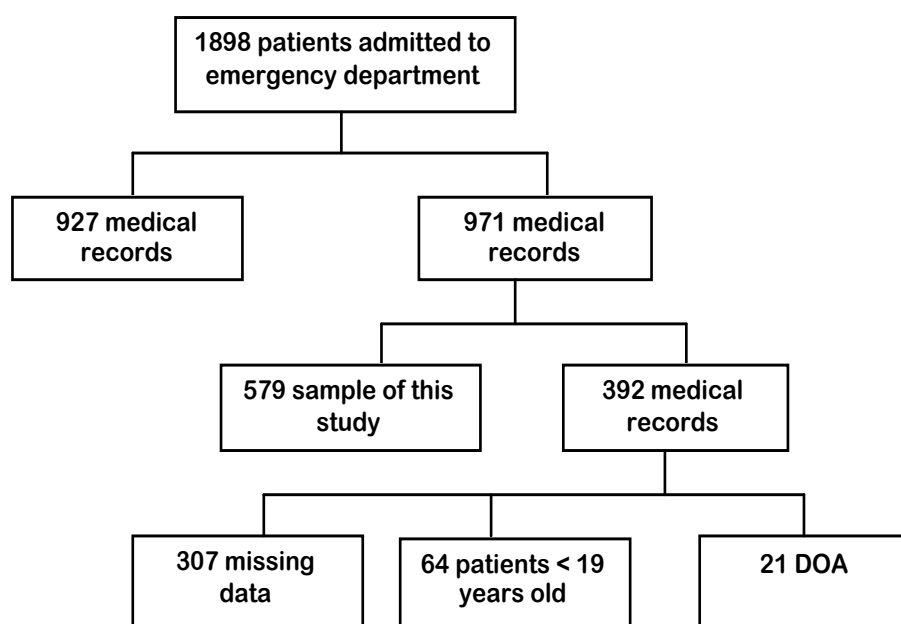

Figure 1. Research Flow

Table 1. Demographic Characteristics of Critically Ill Patients in Emergency Dept., RSCM, 2011

Variable	Cases (n=579)
Age*	45 (18-89) year old
Gender	
Men	350 (60.4 %)
Women	229 (39.6%)
Length of Stay	
< 6 hours	247 (42.7%)
> 6 hours	332 (57.3%)
Indication**	
Decrease in consciousness	262 (45.3%)
Shortness of breath	107 (18.5%)
Shock	57 (9.9%)
Chest pain	35 (6.1%)
Combustio	24 (4.1%)
Apnea	9 (1.6%)
Hypertension emergency	9 (1.6%)
Seizure	9 (1.6%)
Palpitation	7 (1.2%)
Ongoing bleeding	6 (1%)
Level of consciousness	
Alert	250 (43.2%)
Verbal	161 (27.8%)
Pain	129 (22.3%)
Unresponsive	39 (6.7%)
Airway	
Clear	540 (93.3%)
Not clear	30 (5.2%)
with basic airway	3 (0.5%)
with advanced airway	3 (0.5%)
Missing data	3 (0.5%)
Respiratory rate	
Normal	149 (25.7%)
Tachypnea	411 (71%)
Bradypnea	19 (3.3%)
Heart rate	
Normal	259 (44.7%)
Tachycardia	297 (51.3%)
Bradycardia	23 (4%)
Systolic blood pressure	
Normal	249 (43%)
Hypotension	113 (19.5%)
Hypertension	217 (37.5%)
Outcome	
Alive	319 (55.1%)
Dead	260 (44.9%)

*Age is shown in median (min-max)

**Ten most common indications at the admission

Results

In 2011, there were 1898 patients admitted to the ED, with only 971 medical records available and 579 patients were enrolled in this study (Figure 1).

Patient median age was 45 years old. Most patients were male (60.4%). Most patients stayed in emergency department for >6 hours (57.3%). Most common indications were decreased level of consciousness (45.3%), shortness of breath (18.5%), and shock (9.9%). Two hundred and sixty patients died during hospitalization (Table 1).

Almost all patients had oxygen therapy (99%) and intravenous (IV) line (99.5%); 19% patients had intubation and 14.7% patients had CPR (Table 2).

Most of the patients in this study had more than one diagnosis (Table 3) with diseases in circulatory system as the most common (1786 patients /26.5%).

Predicting factors associated with patients' outcomes are level of consciousness, RR, HR, blood pressure, and MEWS in time of admission (ED). Table 4 shows the result of logistic regression analysis of predictors that were proved to affect patients' outcome. Unresponsive patients (level of consciousness) are 12 times more likely to die than alert patients. Bradypnea is the most death predicting factor. Patients with MEWS >4 are 3.8 times more likely to die during hospitalization compared to those with MEWS <4.

Table 2. Treatment of Critically Ill Patients in Emergency Department, RSCM, 2011

Variable	Cases (n=579)
Oxygen	573 (99%)
Intravenous line	576 (99.5%)
Oropharyngeal airways	49 (8.5%)
Advanced airway	
- Intubation	113 (19.5%)
- Tracheostomy	6 (1%)
Cardiopulmonary resucitation	85 (14.7%)
- Yes	58 (10%)
- Do not resuscitate	8 (1.4%)
Cardioversion	88 (15.2%)
Central Venous Catheter	

Table 3. Diagnosis based on ICD-10 of Critically Ill Patients in Emergency Dept., RSCM, 2011

Variable	Cases
Certain infectious and parasitic diseases	202
Neoplasms	21
Diseases of the blood and certain disorders involving the immune mechanism	29
Endocrine, nutritional and metabolic diseases	162
Mental and behavioural disorders	9
Diseases of the nervous system	75
Diseases of the eye and adnexa	3
Diseases of the ear and mastoid process	4
Diseases of the circulatory system	474
Diseases of the respiratory system	274
Diseases of the digestive system	91
Diseases of the skin and subcutaneous tissue	7
Diseases of the musculoskeletal system and connective tissue	10
Diseases of the genitourinary system	154
Obstetry and gynaecology	10
Injury, poisoning and certain other consequences of external causes	182
Shock	55
Others	24

Table 4. Mortality Predicting Factors Analysis of Critically Ill Patients in Emergency Department, RSCM, 2011

	Outcome		OR	95% CI	p value
	Alive	Dead			
Consciousness					
Alert	189 (75.6%)	61 (24.4%)			
Verbal	71 (44.1%)	90 (55.9%)	3.927	2.57-6.00	< 0.001
Pain	51 (39.5%)	78 (60.5%)	4.739	3.00-7.48	
Unresponsive	8 (20.5%)	31 (79.5%)	12.006	5.24-27.51	
RR					
Normal	107 (71.8%)	42 (28.2%)			
Tachypnea	211 (51.5%)	199 (48.5%)	2.403	1.60-3.61	< 0.001
Bradypnea	1 (5%)	19 (95%)	48.405	6.28-373.12	< 0.001
Heart Rate					
Normal	171 (66.0%)	88 (34.0%)			
Tachycardia	146 (49.0%)	152 (51%)	2.023	1.44-2.85	< 0.001
Bradycardia	2 (9.1%)	20 (90.9%)	19.432	4.44-85.03	< 0.001
Blood Pressure					
Normal	154 (61.6%)	96 (38.4%)			
Hypertension	125 (58.4%)	89 (41.6%)	1.142	0.79-1.66	0.484
Hypotension	40 (34.8%)	75 (65.2%)	3.008	1.90-4.77	< 0.001
MEWS					
≤ 4	202 (71.4%)	81 (28.6%)			
> 4	117 (39.5%)	179 (60.5%)	3.815	2.70-5.40	< 0.001

Discussion

The severity of patient's condition can be evaluated from several things. Indication and vital signs at admission and diagnosis during the treatment can show us how severe the patients are.[1,5,6] In this study, the most common indication is decrease level of consciousness. Most of patients had more than one diagnosis. These shows us

that admitted patients had complex condition and in need of intensive care. Decreased level of consciousness indicates that patient's in serious condition. It's related to our findings in which patients with decreased level of consciousness were more likely to die. In conjunction with Barford *et al*,[6] patient with GCS <8 had more mortalities than those with GCS 15.

Vital signs reflect patients' physiological state and severity of their condition.[3] In this study, we found that abnormal vital signs increase the possibility of death during hospitalization. Bradycardic patients are 19 times more likely to die and bradypnic are 48 times. Hypotension can increase the odds of death in critically ill patients. According to Vamos *et al*, patients with abnormal RR (<16 or >20x/minute) had greater risk of death compared to normal patient. In addition, his study also stated that patients with SBP <100mmHg or > 150mmHg were more likely to die compared to normal one.[7] Similar results were also obtained by Merz *et al*.[2] and Barford *et al*.[6] Those studies showed that vital signs abnormality can be a predictor of death in ED patients with critical conditions. Hong *et al*[3] also stated that vital signs were related to 30 days mortality.

Beside vital signs, another useful tool for predicting mortality is MEWS. We tried to evaluate MEWS for predicting mortality of critically ill patients admitted to emergency department. Patients with MEWS >4 were more likely to die compared to MEWS <4. High score of MEWS indicate that patient is more likely to die. Burch *et al* did a study to evaluate the use of MEWS as a triage tool to identify medical patients who are at increased risk of in hospital death. The proportion of patients who died in hospital increased significantly as the MEWS score increased.[8] Another study from Hongkong also stated that MEWS > 4 were associated with increased risk of death (OR 54.4, 95% CI = 4.7-633.7). They also conclude that MEWS may be used as a rapid, simple triage method to identify medical patients at risk of inhospital death.[9]

Conclusion

Vital signs are good predictors of mortality in critically ill patients presenting to ED. Patients with abnormal vital signs, included decrease level

of conscioussness, abnormal HR, and abnormal RR were more likely to die compared to patients with normal vital signs. Patients with MEWS > 4 were also more likely to die compared to MEWS < 4. Therefore, vital signs examination including MEWS, are pivotal in emergency setting.

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