UDC 61

COMPARISON OF THE ACCURACY OF qSOFA AND MEWS SCORE FOR EARLY DETECTION OF SEPSIS

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ABSTRACT

MEWS is a scoring that has been observed for early enforcement of severe sepsis in ED (78,8% sensitivity), whereas qSOFA is a scoring that is still debatable in determining suspicious sepsis patients that is recommended by International Consensus Sepsis-3. The objective of this study is to compare the accuracy between newly applied qSOFA score with previously investigated MEWS in predicting early sepsis in septic patients at Emergency Department (ED), Saiful Anwar General Hospital (SAGH), Malang – Indonesia. This is an observational cross-sectional study to assess the accuracy of qSOFA compared to MEWS in determining early diagnosis of sepsis. We collected the data of patients diagnosed with sepsis for 5 months (July to November 2017) at ED in SAGH Malang. There were 74 patients who met our inclusion criteria. We used lactic acid value of ≥2 as cut off value to diagnose patients with sepsis. Our research data shows that to determine sepsis, qSOFA and MEWS (cut off lactate ≥2) have sensitivity 93.8% vs 81.5%, PPV 87.1% vs 88.3%, Specificity 0% vs. 22.2%, NPV 0% vs 14.3%, Accuracy 82.4 % vs. 74.3%. In addition, the comparison of qSOFA and MEWS as diagnostic tests to predict 24-hour mortality in ED has an accuracy of 22% vs 40.5%, 100% sensitivity vs 94% and specificity 7.1% vs. 23%. qSOFA is more accurate than MEWS in determining suspected sepsis patients (82.4% vs 74.3%) based on lactic acid so that qSOFA can be used as a scoring tool of sepsis at ED Saiful Anwar Hospital. However, qSOFA and MEWS still cannot be used as a scoring tool for predicting 24-hour mortality in ED due to its very low accuracy (22% vs 40.5%) although MEWS accuracy is higher than qSOFA.

KEY WORDS

Lactate levels, MEWS, qSOFA, sepsis

Sepsis is one of the oldest and most elusive syndromes in the world of medicine (Wiersinga et al., 2014). Sepsis causes millions of deaths worldwide each year (Deutschman and Tracey, 2014). Lactate serum is a marker that describes global tissue hypoperfusion and it's used as the gold standard to assess severity in septic patients. According to existing theory, although patients have not experienced hypotension, tissue perfusion has decreased with the presence of cardiac depression, relative hypovolemia due to vascular endothelial leakage, and decreased vasoregulator mechanism. These result in increased oxygen demands, and lactate is formed as a product of anaerobic metabolism that contributes to mortality (Berger et al., 2013).

In its development, The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) 2016 define sepsis as life-threatening organ dysfunction caused by dysregulated host response to infection. It recommends qSOFA (quick Sequential related Organ Function Assessment) as the initial screening of patients with sepsis (Seymour et al., and Singer et al 2016). However, qSOFA is not widely used as an initial assessment of patients with sepsis.

In Indonesia, the mortality rate of patients with sepsis is high. In addition, not all hospitals have lactic acid examination which is the gold standard for sepsis predictors. In

SAGH (SAGH), cases of sepsis ranks 10th out of ten major emergency diseases. Although the prevalence of sepsis decreased from the previous year, it ranked first (15.91%) in the top ten causes of death in hospital (Annual Report SAGH, 2016). Modified Early Warning Score (MEWS) is a scoring that has been observed for early diagnosis of severe sepsis in ED (78.8% accurate, 80.9% sensitivity). When sepsis can be detected early in ED and treated promptly in accordance with the EGDT (Early Goal Direct Treatment) for sepsis, there is a significant decrease in mortality (Berger et al., 2013).

Defining MEWS and qSOFA Score. The qSOFA criteria were defined as systolic blood pressure ≤100mm Hg, respiratory rate ≥22 breaths per minute, and altered mental status (defined as either a Glasgow Coma Scale score ≤13 (Seymour et al., and Singer et al 2016). MEWS criteria were defined as systolic blood pressure, Heart rate, temperature, Respiratory rate and AVPU with calculated based on previously published tables (Bulut, M. et., al. 2013)

METHODS OF RESEARCH

Setting and design. This study was a single-center, cross sectional observational study of patients with clinically diagnosed infection at the ED of Malang Saiful Anwar Hospital from July to November 2017. The hospital is a about 890-bed teaching hospital with approximately 20000 ED visitors per year. This study was approved by the Ethics Committee of our institution. All the patients gave written informed consent.

Patients. Samples were taken by random sampling technique.

Inclusion Criteria:

- Non trauma patients with clinical suspicion of sepsis (fulfilling SIRS criteria for suspected infection);
- Age 15 to 80 years.

Exclusion Criteria:

- Patients with acute heart failure or cardiogenic shock;
- Patients referred from other health facilities that come with attached vasopressor medications or post fluid resuscitation;
- Patients who come with shock conditions due to bleeding..

Data collection. Data on demographic characteristics and vital signs (blood pressure, pulse rate, breathing rate, temperature, GCS/AVPU) were collected. MEWS and qSOFA scores were calculated using the data at enrollment. Lactate serum level of enrolled patients was recorded upon ED arrival.

Data analysis. The data is presented in tabulation with table 2x2 and assessed for sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy. The correlation between each independent variable contained in qSOFA and MEWS and lactate acid level were tested by chi square test. If the correlation of each variable obtained was $p<0.25$, the analysis is continued into a logistic regression test with 95% confidence level, α = 0.05, significant when $p <0.05$.

Table 1 - Patient Characteristics

Characteristics	Σ	(%)
Gender:		
Male	40	54
Female	34	46
Age:		
15 – 30	3	4
31 – 45	14	19
46 – 60	18	24
> 60	39	53

RESULTS AND DISCUSSION

Patient characteristics. There were a total of 105 samples collected from July to November 2017. 32 patients were excluded due to incomplete data. The data from 74

samples were analyzed males and females are 54% vs 46% which the majority of age group of more than 60 years (table 1).

Frequency Distribution. The frequency distribution of each parameter contained in qSOFA varies. The frequency of systolic >100 and ≤100 were not too much different (32 vs 42 samples). Respiration rate ≥22 and GCS <15 have higher frequency (63 and 59 samples). Of MEWS variables, the most frequent respiratory rate (21-29 times per minute), AVPU (pain response) and temperature (35-38.4 ºC) were 44, 32 and 64 samples respectively. Distribution of patients with lactate values ≥ 2 were as many as 65 patients, with the remaining 9 have lactate values of <2. The distribution frequency of qSOFA ≥ 2 and MEWS ≥5 is 70 and 60 patients respectively (table 2).

Table 2 – The Central Tendency

Variable	X	SD	Me	Max	Min
Age (n:74)	57.97	14.587	61.00	80	18
Systole (n:70)	102.86	29.286	99.00	179	60
HR (n:73)	112.23	30.456	112.00	218	37
RR (n:70)	27.71	6.106	28.00	50	16
GCS (n: 74)	9.85	4.255	9.50	15	3
Lactate serum (n: 74)	5.409	4.0628	4.050	19.0	1.1
Temp (n: 74)	36.742	1.0215	36.350	38.9	35.0

X: mean, SD: standard deviation, Me: median, Max: maximum, Min: minimum, HR: heart rate, RR: respiratory rate.

Comparison of qSOFA and MEWS accuracy. The sensitivity of qSOFA in assessing sepsis reflected from ≥ 2 lactate acid level was 93.8%. Specificity was 0%, PPV 87.1%, and NPV 0%. PPV approached 90% and its accuracy was 82.4%. Sensitivity of MEWS in assessing sepsis reflected from lactic acid levels was 81.5%. Specificity was 22.2%, PPV 88.3%, and NPV 14.4% and its accuracy was 74.3% (table 3).

Correlation between qSOFA and MEWS with Lactic Acid Level. Pearson Chi-Square test on the correlations of qSOFA and MEWS with lactate levels found no significant correlation ($p>0.05$). It also did not qualify for regression test.

Table 3 – Comparison of Accuracy between qSOFA and MEWS for early detection of sepsis patients

Criteria	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy (%)
qSOFA	93.8	0	87.1	0	82.4
MEWS	81.5	22.2	88.3	14.4	74.3

Table 4 - Correlation between qSOFA and MEWS with Lactate level

Criteria		Lactate		Σ	P
		< 2	≥2		
qSOFA	<2	0	4	4	
	≥2	9	61	70	1.000
	Total	9	65	74	
MEWS	<5	2	12	14	
	≥ 5	7	53	60	.566
	Total	9	65	74	

Correlations between qSOFA and MEWS with 24-hour Mortality. There is no significant correlation between qSOFA and patient's first 24-hour mortality in the ED of SAGH, so regression test was not conducted (table 5).

Additional. qSOFA and MEWS Score to Predict Patients Mortality. The accuracy of qSOFA and MEWS to predict the patients mortality is 22% vs 40.5% (table 5). The number of

patients with qSOFA ≥ 2 and MEWS ≥ 15 who died within the first 24 hours were 18 and 17 patients respectively.

Table 5 – Correlation between qSOFA and MEWS with 24-hour Mortality

Criteria		Mortality		Total	P
		<24 h	Adm		
qSOFA	<2 ≥2	0 18	4 52	4 70	.566
Total		18	56	74	
MEWS	≥ 5	1	13	14	
	< 5	17	43	60	.096
Total		18	56	74	

Table 6 – Comparison of qSOFA and MEWS score to predict 24-hour mortality

Score	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy (%)
qSOFA	100	7,1	25,7	100	22
MEWS	94	23	28	93	40.5

DISCUSSION OF RESULTS

Of the 74 patients sampled, there were more male patients compared to female patients (54% vs 46%). It is associated with steroid sex hormones that affect the inflammatory response of the body. The most frequent age group is between 65 to 84 years, in accordance to a research conducted by Rezende (Rezende et al., 2008).

.From the above comparison results, in terms of accuracy qSOFA has a slightly higher accuracy compared to MEWS, so qSOFA has a better ability compared to MEWS as a screening tool to establish early diagnosis of sepsis (82.3% accuracy vs 74.3%), although the level of confidence is still low (PPV is less than 90%). MEWS calculations are not much different from previous research results (MEWS in assessing the severity of sepsis reflected by lactic acid levels) by Canaris A 2016 have accuracy of 78.9%.

The total score of qSOFA and MEWS was obtained p> 0,05 so that there was no significant correlation between either qSOFA or MEWS with lactate serum level, so it can not be continued to regression test. This is consistent with previous research, where increased MEWS score was not always followed by increased lactic acid levels (Adrianus K, 2016). In addition, hyperlactatemia in sepsis may also occur as a result of endotoxemia although systemic perfusion, blood pressure and oxygen delivery are within normal limits (Chertoff, 2015). The correlations between each variable contained in qSOFA and MEWS with lactic acid levels can not be analyzed because the data is not homogeneous.

There was no significant correlation between qSOFA and MEWS with 24 hours mortality in the ED. This is probably because the deaths of septic patients usually occur in 3-7 days. In a research conducted by Trzeciak et al. in 2006, patients who died in acute phase (≤3 days) usually have lactate level of ≥ 4mmol. Another study shows a significant association between increased MEWS scores and 7-day mortality (Kruisselbrinket R et., al 2016). However, we did not evaluate mortality in the ICU and wards.

qSOFA score of ≥ 2 in ≤ 24 hours shows higher survival rate compared with hyperlactatemia. This can still indicate a close association or the influence of high lactic acid levels on mortality rates. Besides, the production of lactic acid is also influenced by many factors, including endogenous lactic acid that cannot be measured or predicted and different in each individual.

The qSOFA score has low accuracy than MEWS despite qSOFA has high sensitivity than MEWS in predicting 24-hour mortality. study, One of study National Early Warning Score (NEWS) being the most sensitive score (Churpek, et., Al. 2017). These, may be due to different demographics, number of samples, and different durations of the study.

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