PERFORMANCE OF OBSTETRIC EARLY WARNING SCORE IN PATIENTS WITH SEVERE CONDITIONS FOR THE PREDICTION OF MATERNAL MORTALITY

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Abstract
Introduction:
Obstetric population differs from the general population because of physiologic changes that happen during pregnancy. Many scoring system have been proposed as a potential tool to reduce maternal morbidity and mortality, by assessing abnormal values in vital sign or laboratory parameters. We sought to assess the performance of Obstetric Early Warning Score (OEWS) by Carle et al, to predict the prognosis of obstetric patients receiving ICU treatment using baseline data obtained at the beginning of ICU treatment.
Methodology:
This study is a cohort retrospective study, conducted at H. Adam Malik General Hospital Medan. The study subject was the Medical Record from patients admitted from Febuary 2016 - June 2018. Sample count using the total sampling method. The Obstetric Early warning Score is calculated based on values of the following variables : systolic and diastolic blood pressure, heart rate, respiratory rate, body temperature, fraction of inspired oxygen (FiO2) to maintain O2 saturation of more than or equal to 96% and level of conciousness.
Result:
From the OEWS analysis using the ROC curve it was found that the area under the ROC curve (AUC) with OEWS of 9, was 90.4% (95% CI: 83.1% - 97.8%). With OEWS of 9, we found sensitivity of 85 % and specifisity of 83,3%. Positive predictive value of 65,4% and Negative Predictive Value of 93,8%.
Conclusion:
OEWS in this study has a very good ability to predict maternal mortality (p<0,001 with AUC>90%).

Keyword: ICU, OEWS, Maternal Mortality.

Introduction:

Although supported by advances in Intensive Care Unit (ICU) care standards in recent years, pregnant patients with medical complications are still a challenge for critical care doctors and often require the involvement of a multidisciplinary team. Different approaches to reduce maternal morbidity and mortality have been used, including obstetric early warning score. [1-4]

Bleeding and hypertension disorders constitute the majority of obstetric ICU admissions. Sometimes, requests for care to the ICU are refused due to factors related to the patient's condition. In several studies, identified causes of rejection of ICU treatment in the consist of: older age, diagnosis, the presence of co-morbidity, and the unavailability of beds are strong factors in refusing ICU admission.[5,6]

Carle et al designed the *Obstetric Early Warning Score(OEWS)* to predicts prognosis of obstetric patients receiving care in the ICU based on data collected during the first 24 hours of ICU admission.[7]

The aim of this study is examine OEWS's diagnostic capabilities as a tool for sorting out patients who are eligible for ICU care, so that they can be more selective in allocating available resources.

Methodology :

A single-center retrospective cohort study was designed with all consecutive pregnant and postpartum(up to 40 days) woman who required admission to the ICU of Haji Adam Malik General Hospital in Medan, Indonesia, from Febuary 2016 to June 2018. The ethical board of Faculty of Medicine, Universitas Sumatera Utara approved the study.

Clinical Information was gathered from hospital medical records by the author. Data included demographic variables (maternal age), obstetric variables (parity, pregnancy status, gestational age at time of admission), diagnosis upon admission and during the stay in the ICU, lowest and highest values of vital

signs in the first 24 hours after admission (temperature, systolic and diastolic blood pressure, heart rate, and respiratory rate), and need for critical care interventions such as mechanical ventilator support or use of vasoactive drugs during the ICU stay. The Glasgow Coma Scale (GCS) score was calculated at the time of admission to the ICU.

All categorical variables were expressed in percentages. Statistical analysis were performed using the Mann Whitney and Chi Square test.

To assess the diagnostic performance of the clinical OEWS, model discrimination was estimated using the area under the receiver operator characteristic curve (AUC), and reported with 95% CI. A P value <.001 was considered significant for all analyses. All statistical analyses were performed using statistical software (SPSS Statistics Version 26)

Results:

Characteristics of study subjects in the group that survived and passed away in terms of age, length of stay, use of vasopressin or mechanical ventilation, systolic and diastolic blood pressure, heart rate, respiratory rate, temperature, FiO2, and GCS. Based on the characteristics, both systolic and diastolic blood pressure (BP), heart rate, respiratory rate, FiO2 and GCS showed significant differences between the two study groups (p <0.05).

There was a significant difference in the use of mechanical ventilation and vasopressin drugs in the survivors compared to those who passed away (p <0.001), with a mean of 18 (33.3) v 19 (95) and 4 (7.4) v 17 (85).

There was no significant difference in length of stay in the survivors compared to the group who died (p: 0.165), with a mean of 7.48 (3.59) days and 6.10 (3.52) days.

From the analysis using the ROC curve it was found that the area under the ROC curve (AUC) was 90.4% (95% CI: 83.1% - 97.8%). OEWS in this study has an excellent ability to predict maternal deaths (p <0.001 with AUC> 90%).

Based on the sensitivity and specificity curve in, the Cut Off value for OEWS is 9. By using the cut-off point 9, the sensitivity value of OEWS is 85% and specificity is 83.3%. The Positive Predictive Value (PPV) obtained is 65.4% and the Negative Predictive Value (NPV) is 93.8% with an accuracy rate of 83.8%.

Discussion:

APACHE II was investigated by Paternina et al, by examining the ability of APACHE II and obtained an AUC ROC of 0.86 (95% confidence interval [95% CI], 0.80-0.93,) and found that there was an over-estimation of maternal mortality (MR 0.30 95% CI 0.20-0.45). Harrison et al, Hazelgrove et al, Lapinsky et al (MR 0.43), Mjahed K et al, Karnad DR et al. Also found an over estimation of maternal mortality by APACHE II.[8,9]

In the study of Rojas-Suarez et al, Simplified Acute Physiologic Score (SAPS) II, SAPS III, and Mortality Probability Model III did not accurately predict mortality. SAPS II was also examined by Lapinsky et al and Hazelgrove et al. They obtained conflicting results, with one being a good predictor, and one reporting overestimation (MR 0.43; 95% CI, 0.15-0.93).[8,9]

Significant changes of the physiology of pregnant women, for example in the fields of cardiology, hematology and pulmonology. Cardiac frequency, increased by 20-30% in the 3rd trimester. O2 pressure at the beginning of trimester 1 was reported to be 106-108 mmHg, and decreased to 101-104 mmHg in 3th trimester. Mild leukocytosis is found in all pregnancies. Variations in physiological changes in pregnancy can change the accuracy of the prognosis of prediction models that are not adjusted for pregnant women.[8]

In this study, the cut-off value for OEWS was 9. By using cut-off point 9, the OEWS sensitivity value was 85% and specificity was 83.3%. The Positive Prediction Value (NPP) obtained is 65.4% and the Negative Prediction Value (NPN) is 93.8% with an accuracy rate of 83.8%. Carle et al tried to use OEWS to predict mortality, and found that, with a cut-off value of 12, a sensitivity of 97% was obtained, a specificity of 87% and a total accuracy of 88% .[7]

Conclusion

OEWS in this study has a very good ability to predict maternal mortality

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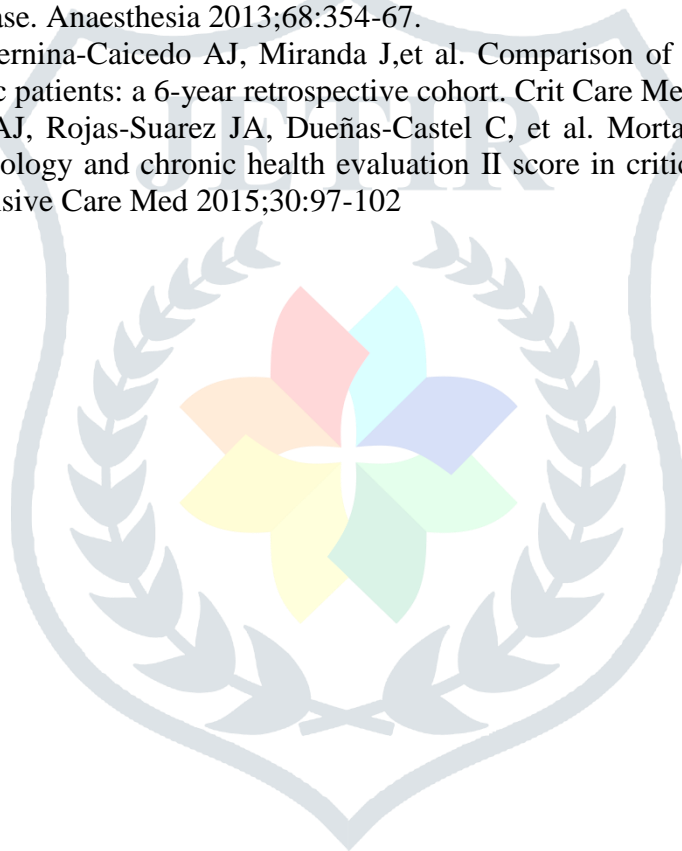
Table 1. Subject Characteristic

Characteristic and Vital SIgn	Passed Away (n=20)	Alive (n=54)	p
Age	29,2 (5,60)	27,57 (7,56)	0,216[a]
Care Length	6,10 (3,52)	7,48 (3,59)	0,165[a]
Vasopresin			
Use	17 (85)	4 (7,4)	<0,001[b]
Not Use	3 (15)	50 (92,6)	
Ventilator, n (%)			
Use	19 (95)	18 (33,3)	<0,001[b]
Not Use	1 (5)	36 (66,7)	
Systolic Blood Pressure	108,4 (39,64)	146,89 (38,82)	0,001[a]
Diastolic Blood Pressure	68,90 (25,93)	94,54 (22,47)	<0,001[a]
Heart Rate	116,15 (22,47)	99,93 (15,10)	<0,001[a]
Respiratory Rate	26,90 (6,41)	22,37 (3,32)	<0,001[a]
Temperature °C	36,61 (1,13)	36,85 (2,09)	0,077[a]
FiO_2,	8,45 (2,09)	3,09 (2,88)	<0,001[a]
GCS,	8,95 (3,47)	14,24 (2,85)	<0,001[a]

[a]Mann Whitney, [b]Chi Square

Table2. ICU Indication

Diagnose	Outcome		Case Fatality Rate
	Alive	Passed Away	
Preeklampsia/Eclampsia	22	7	24.1%
PPH	12	5	29.4%
Heart Diseases	4	2	33.3%
Sepsis	0	6	100%
Others	15	0	0%

Table 3. Obstetric Early Warning Score (OEWS)

	Alive (n=20)	Passed Away (n=54)	p*
Mean	11,85	5,98	**<0,001**
SD	2,85	3,43	
Median	12	7	
Minimum	7	0	
Maximum	17	13	

*****Mann Whitney**

Figure 1. OEWS ROC Curve
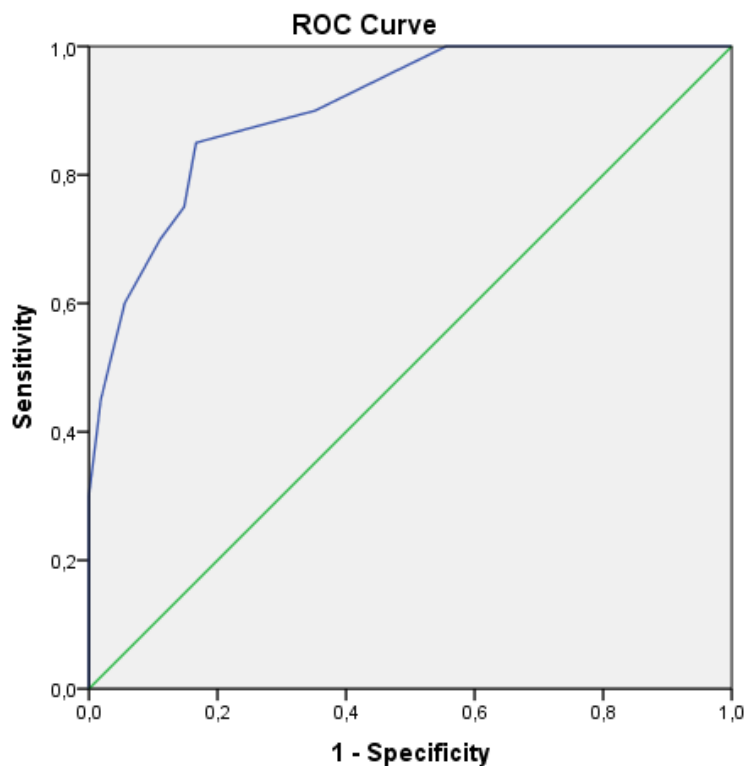
Diagonal segments are produced by ties.
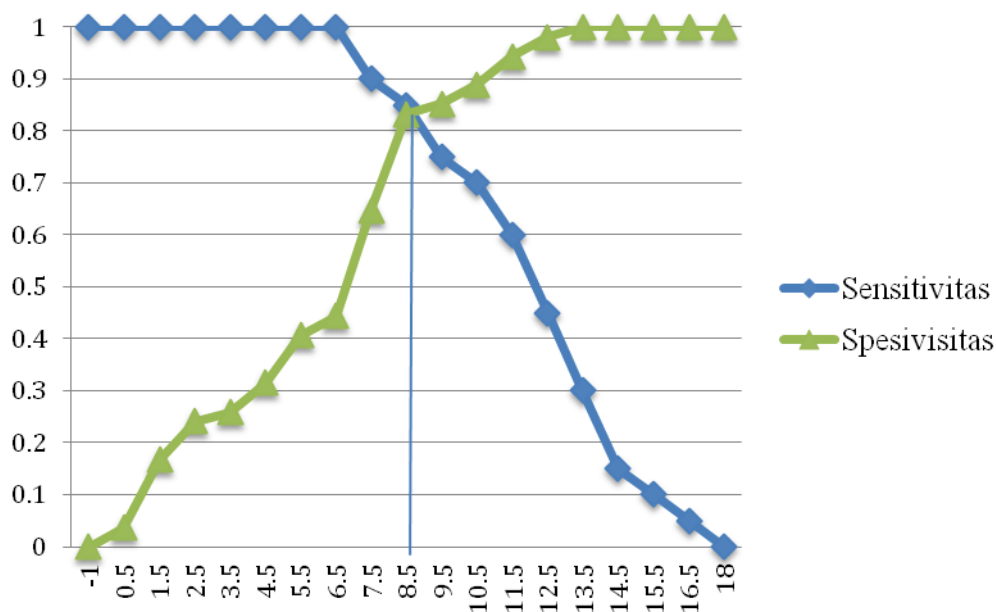
Figure 2. Sensitivity and Specificity of OEWS

Table 4. Accuracy of OEWS

OEWS	Sensitivity	Specificity	PPV	NPV	Accuracy
≥ 9	85%	87,1%	65,4%	93,8%	83,8%