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Original Research Article

Use of Obstetric Early Warning Score in Critically Ill Patients for Prediction of Maternal Death

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Conflict of interest: Nil

Abstract:

Objective: To assess the performance of Early Warning Obstetric Score in predicting maternal death among obstetric patients who required admission in ICU.

Methods: Prospective observational study on patients admitted in ICU. Information regarding sociodemographic variable and gestational age was gathered at the time of admission. Detailed clinical history regarding mode of presentation, clinical features, duration of symptoms etc. were obtained and entered in questionnaire. Further, patients were subjected to detailed clinical and general examination. Also, diagnosis upon admission and duration of stay in the ICU were noted and entered in questionnaire. The need for critical care interventions such as mechanical ventilator support, requirement of drugs if any was determined.

Results: Majority of patients belonged to age group 21-30 years (46.5%) .Most of them belonged to rural areas (67.1%) and to lower socioeconomic status (73.1%) .Majority of patients were referred 60% and only 0.5% were booked at our hospital .Majority of patients were primiprous (60.6%) and majority underwent LSCS (50.85%). OEWS was significantly higher in non survivors (>4 trigger in 86% of non survivors; p value<0.05. OEWS was significantly lower in patients who do not require any ventilatory or vasoactive support. Length of ICU was significantly greater in patient with higher trigger score.

Conclusion: Delay in identification of complications during pregnancy is associated with higher odds of maternal mortality. Therefore, Early Warning System (EWS) have been proposed as a promising tool which may help in early identification of warning signs in pregnant female. This may aid in initiating rapid medical response and reducing maternal morbidity as well as mortality.

Keywords: Early Warning System (EWS), ICNARC OEWS (Obstetric Early Warning System) scale

Introduction

Pregnancy and childbirth are universally celebrated physiological events. However, small proportions of pregnancies may present with various complications.Every

day, about 830 women die worldwide from preventable causes related to pregnancy and childbirth. These complications may be associated with adverse maternal and neonatal outcomes in terms of morbidity and mortality. Obstetric early warning scores have been proposed as a potential tool to reduce maternal morbidity and mortality, based on the identification of predetermined abnormal values in the vital signs or laboratory parameters, to generate a rapid and effective medical response.

Maternal mortality has been regarded as one of the key indicator of health and socioeconomic development of the country as it reflects health system of the country. Currently, maternal mortality ratio in India is 113 per 100000 live birth, according to SRS data (2016 to 2018) whereas maternal mortality ratio of Madhya Pradesh is estimated to be 173 per 100000 live birth. Reducing the maternal mortality rate to less than 70 per 100000 live births by the year 2030 is one of the agenda of sustainable development goal to achieve the goal of ensuring healthy lives and promote well-being for all at all ages. [1-4]

Early and prompt identification of females at risk of developing complications during the pregnancy or delivery may help in preventing maternal as well as neonatal morbidity and mortality. According to World Health Organization, antenatal period present multiple opportunities during which a pregnant female can be reached, which can be vital to their health and wellbeing. Antenatal care i.e. at least 4 antenatal visits increases the likelihood of receiving effective maternal health interventions. Therefore pregnant females are encouraged for antenatal visits so that their physiological changes can be monitored during the pregnancy. These visits can be utilized to identify the high risk pregnant females. Variation from normal physiological parameters is one of the important sign of underlying or developing serious illness. [6] This helps in early identification of at risk mothers and outcome of patient can be significantly improved by early diagnosis and appropriate management. [5,6]

Till date, ICNARC-OEWS is the only obstetric early warning system designed to assess the maternal death as main outcome on large sample size. Literature assessing the performance of Early Warning Obstetric Score in critically ill patients requiring ICU admission for predicting maternal death is scarce in Indian Scenario. Since maternal death are commonly observed in ICU settings, use of early warning system may help in proper allocation of resources. The present study was therefore conducted at tertiary care centre to assess the performance of Early Warning Obstetric Score in predicting maternal death among obstetric patients who required admission in ICU. [7-9]

Materials and Methods

The present study was conducted on pregnant females admitted in ICU, Gandhi Medical College and associate Sultania Zanana Hospital due obstetric complication of pregnancy or complications aggravated by physiological effect of pregnancy during the study period of one year.

Study design: Prospective observational study

Study Population: Pregnant females admitted in ICU, due obstetric complication of pregnancy or complications aggravated by physiological effect of pregnancy

Study Area: ICU, Gandhi Medical College and associate Sultania Zanana Hospital

Study duration: 1 year from 1st July 2020 to 3oth June 2021.

Sample size: 400 cases

Inclusion Criteria

- Women admitted in ICU resulting from obstetric complication of

pregnancy state (pregnancy, delivery, postpartum) or chain of events resulting from pregnancy related disorders (hypertensive disorder of pregnancy).

- Women admitted in ICU resulting from preexisting condition or conditions that developed during pregnancy and may have aggravated by physiological effect of pregnancy.

Exclusion Criteria

1. Women who had any following benign gynecological disease.

- Fibroid uterus
- Adenomyosis
- Dysfunctional uterine bleeding
- Pelvic organ prolapse
- CIN
- Ovarian Cyst.

2. Women with malignant gynecological disorder

Written consent

Written consent was obtained from all the study participants after explaining them nature and purpose of the study. They were ensured that confidentiality will be maintained and option to withdraw from the study was always kept open.

Methodology: After seeking authorization from Institute's ethical committee, Dean, GMC, Bhopal and Head of Department, Department of Obstetrics and Gynaecology, SZH, Bhopal a prospective observational study was conducted on patients admitted in ICU after taking their consent. All the patients were enrolled within 24 hours of their admission. Information regarding sociodemographic variable such as maternal age socioeconomic status (parity, pregnancy status) and gestational age was gathered at the time of admission. Detailed clinical history regarding mode of presentation, clinical features, duration of symptoms etc. were obtained and entered in questionnaire. Further, patients were subjected to detailed clinical and general examination; vital signs such as Temperature, systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate were noted in first 24 hours of admission. Also, diagnosis upon admission and duration of stay in the ICU were noted and entered in questionnaire. The need for critical care interventions such as mechanical ventilator support, requirement of drugs if any was determined.

ICNARC OEWS scale was used for assessment of critical illness in these patients.[14] The OEWS is calculated based on values of following variables.

1. Abnormal systolic blood pressure.
2. Abnormal diastolic blood pressure.
3. Abnormal respiratory rate.
4. Abnormal heart rate.
5. Abnormal temperature
6. Abnormal FiO2
7. Abnormal Glasgow coma Score

Table 1: Results Of OEWS Triggers In Obstetrical Critical Care Patients and Selected Maternal Outcome

ALL ADMISSIONS	**Response**
OEWS 0	Routine
OEWS 1-3	Low
OEWS >4	Medium
OEWS >6	High
INDIRECT ADMISSIONS	**Response**
OEWS 0	Routine
OEWS 1-3	Low
OEWS >4	Medium
OEWS >6	High
DIRECT ADMISSIONS	**Response**

OEWS 0	Routine
OEWS 1-3	Low
OEWS >4	Medium
OEWS >6	High

Observation chart

Table 1: Distribution of patients according to age

Age groups (years)	N	%
≤ 20	129	36.9
21 – 30	163	46.5
31 – 40	58	16.6
Total	350	100

Table 2: Distribution of patients according to area of residence

Area of residence	N	%
Rural	235	67.1
Urban	115	32.9
Total	350	100

Table 3: Distribution of according to socio-economic status

Socio-economic status	N	%
Lower	256	73.1
Upper lower	36	10.3
Lower middle	58	16.6
Total	350	100

Table 4: Distribution of patients according to booking status

Booking Status	No. of Cases	%
Booked	18	0.05%
Unbooked	122	34%
Referred	210	60%

Table 5: Distribution of patients according to parity

PARITY	N	%
Primigravida	212	60.6
Multigravida	108	30.9
Grand-multigravida	30	8.5
Total	350	100

Table 6: Distribution according to obstetrics intervention

Obstetric Intervention	No. of Cases	%
Vaginal Delivery	50	14.2%
LSCS	178	50.85%
Laparotomy Rupture uterus Ectopic pregnancy	 11 9	5.71%
MVA	14	4%
Undelivered	88	25.14%

Table 7: Distribution of patients according to requirement of ventilatory support

Ventilatory support	N	%
Yes	194	55.4
No	156	44.6
Total	350	100

Table 8: Distribution of patients according to requirement of vasoactive support

Vasoactive support	N	%
Yes	177	50.6
No	173	49.4
Total	350	100

Table 9: Distribution of patients according to length of ICU stay

ICU stay (Days)	N	%
1 – 2	52	14.8
2 – 5	183	52.3
> 5	115	32.9
Total	350	100

Table 10: Distribution of patients according to OEWS at admission

OEWS at admission	N	%
0	19	5.4
1 – 3	65	18.6
≥ 4	162	46.3
≥ 6	104	29.7
Total	350	(100

Table 11: Distribution of patients according to OEWS at 24-hours

OEWS at 24-hours	N	%
0	26	7.4
1 – 3	102	35.7
≥ 4	120	34.3
≥ 6	90	25.6
Total	350	100

Table 12: Distribution of patients according to maternal outcome

Maternal outcome	N	%
Shifted to ward	242	69.1
Death	108	30.9
Total	350	100

Table 13: Obstetric indications of obstetric ICU admission

S. No.	Indication	No. Of cases	%
1	Hypertensive disorder with complications	136	57.87%
2	Obstetric haemorrhage with shock	65	27.65%
3	Septicaemia	34	14.4%

Results

In our study majority of patients belonged to age group 21-30 years (46.5%) .Most of them belonged to rural areas (67.1%) and to lower socioeconomic status (73.1%) .Majority of patients were referred 60% and only 0.5% were booked at our hospital

.Majority of patients were primiprous (60.6%) and majority underwent LSCS (50.85%)

Ventilatory (55.4%) and vasoactive (50.5%) was required in management of patients. The mean length of ICU stay was 3.4 days, majority of patients had an ICU stay of 2-5 days. On admission (46.3%) and after 24 hours of admission (34.3%) ,patients had OEWS Of >=4

With proper timely recognition and availability of intervention OEWS score model can be used to improve the health condition in a parturient thus by aiming to reduce the OEWS score value by proper monitoring. Of 350 critically Ill patients ,242 (69.1%) survived and remaining 108 patients died. Most common underlying condition leading to obstetrics ICU admission was hypertensive disorder (57.85%). The ability of OEWS model to discriminate between survivors and non survivors in direct (AUC -0.87%) and indirect obstetric causes (0.95%) was very predictive among both. OEWS was significantly higher in non survivors (>4 trigger in 86% of non survivors; p value<0.05. OEWS was significantly lower in patients who do not require any ventilatory or vasoactive support. Length of ICU was significantly greater in patient with higher trigger score.

Statistical Analysis:

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

Discussion

Patients at a risk of rapid deterioration and critical illness often have preceding changes in their physiological parameters. Identifying such patients at an early stage using a simple protocol, based on physiological parameters may avoid maternal mortality. An early warning system (EWS) uses physiological parameters to track a patient's condition, detect deterioration early and trigger an increased level of care. An EWS has three components: (*i*) Early warning score - a tool to aid the recognition and management of a pregnant women whose condition is deteriorating; (*ii*) Tracking - periodic observation and recording of physiological parameters on an observation chart; and (*iii*) Trigger - predetermined cut-off score will trigger the summoning of help, involving a timely response and an appropriate level of assistance. [10]

The Present study aims to propose the ICNARC- OEWS as a prospective score model for predicting mortality and morbidity in critically ill patients in obstetric ICU. This one is one of a few study in India based in a tertiary care centre in central India, Sultania Zanana Hospital, Bhopal. This study was conducted to analyze the clinical and sociodemographic profile and to apply ICNARC OEWS For prediction of maternal mortality and morbidity among patients admitting to obstetrics ICU.In our study, a total 350 patients admitted to obstetric ICU were analyzed. There were 102 deaths and 242 survived. [11]

Paternina-Caicedo A et al sought to assess the performance of the Intensive Care National Audit and Research Center Obstetric Early Warning Score in predicting death among pregnant women who required admission to the intensive care unit. This retrospective cohort study included pregnant women admitted to the intensive care unit at a tertiary referral center The Obstetric Early Warning Score is calculated based on

values of the following variables: systolic and diastolic blood pressure, respiratory rate, heart rate, fraction of inspired oxygen (FiO_2) required to maintain an oxygen saturation ≥96%, temperature, and level of consciousness. The performance of the Obstetric Early Warning Score was evaluated using the area under the receiver operator characteristic curve. Outcomes selected were: maternal death, need for mechanical ventilation, and/or vasoactive support. The overall predictive value of the Obstetric Early Warning Score was better when the main cause of admission was directly related to pregnancy or the postpartum state. Although there are opportunities for improvement, Obstetric Early Warning Score obtained upon admission to the intensive care unit can predict survival in conditions directly related to pregnancy and postpartum. The use of early warning scores in obstetrics may be a highly useful approach in the early identification of women at an increased risk of dying.

A systematic literature review was done by Umar A et al on several versions of Early Warning Systems (EWS) are used in obstetrics to detect and treat early clinical deterioration to avert morbidity and mortality. Obstetric EWS are effective in predicting severe morbidity (in general obstetric population) and mortality (in critically ill obstetric patients). EWS can contribute to improved quality of care, prevent progressive obstetric morbidity and improve health outcomes. There is limited evidence of the effectiveness of EWS in reducing maternal death across all settings. Clinical parameters in most obstetric EWS versions are routinely collected in resource-limited settings, therefore implementing EWS may be feasible in such settings.

Obstetric early warning score (OEWS) has been used conventionally for early identification of deteriorating obstetric patients in the labor room and ward settings. This study was conducted by Khergade M et al to determine if this could be used for prognosticating a critically ill patient in the ICU setting instead of sequential organ failure assessment score (SOFA) and acute physiology and chronic health evaluation (APACHE II) score. The standardized mortality ratio (SMR) for OEWS, SOFA, and APACHE II was 66.3, 62.5, and 69.15%, respectively. Xu Y et al gave a new modified obstetric early warning score for prognostication of severe maternal morbidity. Thus it was concluded that obstetric early warning score is as effective as the conventional SOFA and APACHE II to prognosticate the obstetric patient. Since OEWS is based only on clinical criteria, it can be done immediately on admission and can help in early allocation of appropriate manpower and resources for optimum outcome.

High-risk obstetric patients have chances of deterioration which can be detected by any early warning score. This study by Rathore AM et al was aimed to assess the suitability of the Obstetrics National Early Warning System (ONEWS) for the pregnant women. The primary outcome measure was composite adverse maternal outcome (CAMO) in the form of one or more among mortality, severe maternal morbidity and intensive care unit admissions. ONEWS appeared to be a useful tool for predicting adverse maternal outcomes in high-risk pregnant women.

Nair S et al worked on Irish Maternal Early Warning Score. The Obstetric Early Warning Score (OEWS) aims to promote early recognition of the pregnant patient at risk of deterioration. In 2013, a standardised Irish Maternity Early Warning System (IMEWS) was introduced nationally. However, the scoring system is only part of the package, once triggered it needs to be effectively communicated and acted upon promptly by appropriately trained clinicians. Despite undoubted shortcomings, the international evidence to date is supportive of the beneficial role of the OEWS in preventing maternal

morbidity. They concluded that further research is needed to improve the sensitivity and specificity of the OEWS and how to better integrate it into every-day clinical practice.

Rudakemwa A et al studied the high mortality rate of obstetric critically ill women in Rwanda and its predictability of Obstetric Early Warning Score (OEWS).This study aimed to assess reasons for admission and accuracy of prediction models for mortality of obstetric patients admitted to ICUs of two public tertiary hospitals in Rwanda. Authors analysed the accuracy of mortality prediction models by MEOWS or qSOFA by using logistic regression adjusting for factors associated with mortality. It was concluded that **s**epsis and obstetric haemorrhage were the commonest reasons for obstetric admissions to ICU in Rwanda. MEOWS and qSOFA scores could accurately predict ICU mortality of obstetric patients in resource-limited settings.

Similar study was done on epidemiology, outcomes, and risk factors for mortality in critically ill women admitted to an obstetric high-dependency unit in Sierra Leone by Marotta C et al.The primary endpoint was the association between risk factors and high-dependency unit (HDU) mortality. The factors independently associated with HDU mortality were ward rather than postoperative referrals. Critically ill parturients were predominantly referred with a red OEWS code and usually required intermediate care for 48 hours. Despite the provided interventions, death in the HDU was frequent, affecting one of 10 critically ill parturients. Medical admission, a red OEWS code, and a poor neurological and hemodynamic status were independently associated with mortality, whereas adequate oxygenation was associated with survival.

Arnolds DE et al did comparison of early warning scores for predicting clinical deterioration and infection in obstetric patients. Within the limitations of their retrospective study, eCART had the highest accuracy for predicting deterioration and infection in our ante- and postpartum patient population. Maternal early warning scores were more accurate than MEWS and NEWS. While institutional choice of an early warning system is complex, our results have important implications for the risk stratification of maternal ward patients, especially since the low prevalence of events means that small improvements in accuracy can lead to large decreases in false alarms.

Carle C et al designed and internally validated an aggregate weighted early warning scoring system specific to the obstetric population that has the potential for use in the ward environment. Physiological variables collected during the first 24 h of critical care admission were analysed. Logistic regression analysis for mortality in the model development set was initially used to create a statistically based early warning score. The statistical score was then modified to create a clinically acceptable early warning score. Important features of this clinical obstetric early warning score are that the variables are weighted according to their statistical importance, a surrogate for the F_IO_2/P_aO_2 relationship is included, conscious level is assessed using a simplified alert/not alert variable, and the score, trigger thresholds and response are consistent with the new non-obstetric National Early Warning Score system. This highlights that the new clinical obstetric early warning score has an excellent ability to discriminate survivors from non-survivors in this critical care data set. Further work is needed to validate our new clinical early warning score externally in the obstetric ward environment.

Conclusion

Delay in identification of complications during pregnancy is associated with higher

odds of maternal mortality. Therefore, Early Warning System (EWS) have been proposed as a promising tool which may help in early identification of warning signs in pregnant female. This may aid in initiating rapid medical response and reducing maternal morbidity as well as mortality.

Declarations:

Funding: None

Availability of data and material: ICU, Gandhi Medical College and associate Sultania Zanana Hospital

Code availability: Not applicable

Consent to participate: Consent taken

Ethical Consideration: There are no ethical conflicts related to this study.

Consent for publication: Consent taken

Limitations of Study

The finding of study must be weighed against the potential limitations of the study , including relatively small sample size. Even with rigorous methodology, risk of random error caused by intrinsic data variations remains, but can be mitigated by increasing sample size, in the midst of nascent covid pandemic adequate sample size and other commonly accepted standards of medical research have been set aside.

Despite the benefits of EWS in the obstetric population and its association with decreased severe maternal morbidity, warning systems generate a large number of false positive findings which might generate an excessive burden on health care systems.

What This Study Add to Existing Knowledge

Early warning system (EWS) is based upon physiological observations and combine the clinical signs and symptoms, findings of clinical examination and laboratory tests to identify the pregnant females at high risk of developing complications. This system is developed to facilitate early identification and recognition of clinical deterioration community or primary health set up by midwives. In this system, whenever any abnormal finding is identified (also called trigger) by the peripheral health worker, additional help is taken from higher health care centers in the form of referrals. EWS can contribute to improved quality of care, prevent progressive obstetric morbidity and improve health outcomes. her centers to confirm the altered health status and to provide appropriate intervention or care.

Contribution by Different Authors

First author Dr Mrs Aruna Professor & Head of Department Department of Obstetrics and Gynaecology Gandhi Medical College, Bhopal Concept and Guidance

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