"Validation Study Of the Confidential Enquiry into Maternal And Child Health Recommended Modified Early Obstetric Warning System as a Predictor of Obstetric Morbidity"

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I. Introduction

Maternal deaths have been described as the tip of the iceberg and maternal morbidity as the base. For every woman who dies of pregnancy-related causes, 20 or 30 others experience acute or chronic morbidity, often with permanent sequelae that undermine their normal functioning.1,2 This can affect women's physical, mental or sexual health.2,3 Not surprisingly, the burden of maternal morbidity , like that of maternal mortality , is estimated to be highest in developing countries, especially among low socioeconomic status.4

The causes of maternal morbidity vary in duration and severity and cover a broad range of diagnoses requiring a wide variety of treatments. Maternal morbidity can be conceptualized as a spectrum ranging, at its mostsevere, from a "maternal near miss" – defined by the World Health Organization (WHO) as the near death of a woman who has survived a complication occurring during pregnancy or childbirth or within 42 days of the termination of pregnancy5 – to non-life-threatening morbidity, which is more common by far.In an attempt to improve the patient's care various types of EWS – Early Warning System is being used in different places.EWS uses physiological parameters to track a patient's condition to detect early deterioration and to trigger an increase in care. Timely intervention will thus help reduce maternal mortality and morbidity.

The CEMACH established in April 2003, recommended the introduction of MEOWS in all obstetric inpatients to help in early identification and treatment of deteriorating parturient.Development of such a score which can be applied anywhere is quite helpful and would facilitate identification of sick women and initiate the right action at right time by appropriate skilled clinician. This can also be used to assess the severity of illness and predict outcomes in patients in critical care area.

In a developing country like India, the bulk of near miss is contributed mainly by the referral system.They are referred in emergency to a higher centerfor better care and thereby referral at the right time along with the score sheet which would give all the important details pertained to the sick women.Thus I have conducted this study to evaluate the feasibility and to validate a warning system like MEOWS as a predictor of obstetric morbidity so that it can be used as a screening tool to identify women at risk and as a monitoring tool to predict outcomes in women in Indian population.

Early Warning System (EWS) like MEOWS should be evaluated and should be implemented in India because
 Morbidity is more in number than mortality
 Aids in early diagnosis and timely intervention thereby reducing mortality
 It yields information to pathway of death

II. Aim Of The Study

 To evaluate and validate "Modified Early Obstetric Warning System" (MEOWS) recommended by Confidential Enquiry into Maternal And Child Health [CEMACH, U.K.], as a tool for predicting maternal morbidity in pregnant women.

III. Objectives Of The Study

 To measure the sensitivity and specificity of MEOWS in prediction of maternal morbidity.
 To measure the positive predictive value and negative predictive value in prediction of maternal morbidity.
 To study and analyse maternal near miss cases and the additional potential variables.

IV. Material And Methods

STUDY DESIGN: Prospective observational study
PLACE OF STUDY: Department of Obstetrics and Gynecology,Coimbatore Medical College Hospital,Coimbatore.

SAMPLE SIZE: Number of patients: 189
PERIOD OF STUDY September 2015 – September 2016
CONSENT
Patients were recruited after informed consent .
INCLUSION CRITERIA: Any women during pregnancy or within 42 days of delivery or termination of pregnancy who has any one or more of the following-
1. Admitted in our labour room.
2. Post operative patients.
EXCLUSION CRITERIA:
1. Women brought in shock or who died immediately after admission
2. Women who were admitted directly to ICU
MATERIAL: MEOWS chart adapted from the seventh CEMACH report (2003-2005). The following observations are required on all women

MEOWS Chart first page
Temperature
Blood pressure
Respiratory Rate
Pulse
Saturations and O2 therapy [If woman triggers]
MEOWS Chart second page
Neuro response
Pain score[post operative only]
Lochia [Post natal]
Looks unwell
Women should retain the same MEOWS chart when moving from one clinical area to another so that physiological trends can be observed. A full set of observations is required at each assessment as there are 5 physiological variables that are regularly measured: ·
Respiratory rate ·
Pulse rate ·
Blood pressure ·
Temperature ·
Mental state

TRIGGERING ON MEOWS CHART
TRIGGER: In the chart,one observation in the Red or two observations in the Yellow indicates a trigger. It is important to remember when the woman triggers she requires
 Referral to appropriate level Doctor
 Monitoring
 Review
 Investigations
 Plan of care
Recognition of deterioration in condition does not necessarily mean diagnosis but does mean investigation and appropriate level referral involving a multidisciplinary approach.
Actions to take when a woman is Triggering on the MEOWS Chart
Action:
• Attend within 10 minutes or send deputy
• Confirm observations Take history & examination
• Decide on differential diagnosis

V. Methodology:
For each case, informed written consent is obtained. Detailed history and information on socio-demographic characteristics such as age, parity, socioeconomic status (modified Kuppuswamy scale), educational status (illiterate, school, graduation, higher education) , interpregnancy interval (in months) ,gestational age at the time of the near-miss morbidity, antenatal check up nature of the obstetric complication(s), presence of organ and/or system dysfunction and duration of hospital stay are entered in the chart. The patient is followed until discharge.Complete physical examination was done. Investigations already done for the patient were noted for booked patients. For emergency patients basic investigation and additional investigations were sent as required for clinical management of the patients. MEOWS chart was made available

in LR. Early warning scoring was done 4- 12 hourly for the first 24 hours after inclusion. The proforma is filled by questioning method. The laboratory results are also collected and entered in the proforma. Frequency of observations is determined by:

 Risk Status
 Diagnosis
 Reason for admission
 Initial observations on admission
 Completing the MEOWS chart
 Top section to include woman's details
 Date
 Frequency of observation
 Time (24 hr clock)
 Signature at bottom section

Compliance was noted (no /partial/complete)- for monitoring and medical review. Outcome measures were noted and entered in predesigned proforma.

OUTCOMES:
Maternal morbidity
 Discharged

VI. Data Management & Statistical Analysis:
The main objective of the study was to validate the MEOWS chart. After completeness of data, they were entered into a database using Microsoft Excel 2007. The descriptive analysis was carried out comparing the different criteria of maternal morbidity. All the entries were checked for any possible key word error. Performance of scoring system was checked by computing its positive and negative predictive value. Sensitivity, Specificity, positive predictive value and negative predictive value of the cut of the score will be computed. Measures of central tendency were estimated for continuous variables and measures of frequency for categorical variables.

Table 1: Distribution of cases according to age in years

Age in years	Number of patients	Percentage
20& less	36	19.0
21-25	89	47.1
26-30	38	20.1
31-35	16	8.4
36-40	10	5.2
Total	**189**	**100.0**

Table 2: Distribution of patients according to parity

Parity	Number of patients(n)	Percentage (%)
Primi	78	41.3
Multi	111	58.7
Total	**189**	**100.0**

Table 3: Distribution of patient according to level of education & incidence of near miss maternal morbidity

Literacy Status	Number of patients(n)(%)	Near Miss Maternal Morbidity (%)
Illiterate	44(23.3)	20 (10.6)
Primary	74(39.2)	10 (5.3)
Secondary	45(23.8)	4 (2.1)
Graduate	26(13.8)	2 (1.1)
Total	**189(100)**	**36 (19)**

Table 4: Distribution of patients according to socioeconomic status & incidence of near miss maternal morbidity

Socioeconomic Status	Number of patient'sn (%)	Near Miss Maternal Morbidity (%)
Lower	94(49.7)	18 (9.5)

Lower Middle	86(45.5)	17 (9)
Upper Middle	9(4.8)	1 (0.5)
Upper	0(0)	0 (0)
Total	**189(100)**	**36 (19)**

Table 5: Distribution of patients according to quality of antenatal care & incidence of near miss maternal morbidity

Antenatal Care	Number of patient's n (%)	Near Miss Maternal Morbidity (%)
Emergency	60 (31.7%)	24 (12.7)
Booked	129 (68.25%)	12 (6.3)
Total	**189(100)**	**36 (19)**

Table 6: Distribution of patients according to period of gestation at recruitment

Period of Gestation at Recruitment	Number of patients n	Percentage
2nd trimester	4	2.1
3rd trimester	173	91.5
Postpartum	12	6.3
Total	**189**	**100**

Table 7: Distribution of patients according to outcomes

Outcome	Number of Patients	Percentage
Normal	153	81
Near Miss	36	19.0
Total	**189**	**100**

Table 8: Distribution of patients according to cause

Morbidity	Number of patients (n)	Percentage
Pre-Eclampsia/Eclampsia	6	16.6
ObsHaemorrage	27	75
Sepsis	3	8.3
Total	**36**	**100**

Table 9: Distribution of patients according to trigger parameters

Trigger Parameters	No. of patients	Near miss maternal morbidity (%)	P Value	Relative risk of morbidity (95% confidence interval)
Temperature <35 or >38	8	6 (16.7)	0.000	4.525 (2.699-7.585)
Systolic BP <90 or >160	16	13 (36.1)	0.000	6.111 (3.907-9.560)
Diastolic BP >100	17	13 (36.1)	0.000	5.719 (3.600-9.084)
Pulse <40 or >120	31	27 (75.0)	0.000	15.290 (7.992-29.253)
Spo2 < 95	4	2 (5.6)	0.111	2.721 (0.975-7.590)
Respiratory Rate	7	5 (13.9)	0.000	4.194 (2.377-7.399)
Amniotic fluid	9	3 (8.33)	0.263	1.818 (0.686-4.816)
Neuroresponse	5	1 (2.8)	0.956	1.051 (0.178-6.224)
Pain score	3	0 (0.00)	0.397	0.000 (0.000-0.000)

Sensitivity   **70.00**
Specificity   **84.3**
Positive predictive value   **21.60**
Negative predictive value **97.82**

VII.   Summary

This study entitled *"Validation Study Of The Confidential Enquiry Into Maternal And Child Health Recommended Modified Early Obstetric Warning System As A Predictor Of Obstetric Morbidity"* conducted in Department of Obstetrics and Gynecology at Coimbatore Medical College,Coimbatore,fromSeptember 2015-September 2016,189 patients were enrolled into the study with due consideration to inclusion and exclusion criteria. Charting was done 4-12 hourly for the first 24 hours and outcome were assessed and followed up till discharge from hospital.

Mean age of participating women was 25.76 ± 6.598 years ranging from 17 to 40 years, with maximum (47.1%) patients belonging to 21 -25 years.

Maximum of the subject was multiparous (58.7%).

Literacy level in our study was 23% illiterate, 39% primary pass, 23% secondary pass out and 15% were graduates. Association between literacy level and near miss maternal morbidity was statistically significant (p value< 0.001). Near miss maternal morbidity was mainly seen in illiterate.

Socioeconomically our population belongs to lower socio economic status (49.73%). But in this study the association between socioeconomic status and near miss maternal morbidity was not significant (p value >0.001). Proportion of women having adequate antenatal care was 68.2% which justify that major population were booked. The incidence of near miss was 12.7% which is statistically significant(p value<0.001). Majority of population in this study were antenatal 177(93.6%).

Most common cause of near miss maternal morbidity was obstetric hemorrhage 75% followed by hypertensive disease of pregnancy 16.6% and sepsis 8.3%.

The most frequent trigger was pulse rate (75%), followed by diastolic BP (36%) and systolic BP (36%).Temperature (16%), oxygen saturation (5.5%), respiratory rate (3.2%), and the least frequent trigger was pain score.

The sensitivity of MEOWS in predicting near miss maternal morbidity was 70%, specificity 84.3%, positive predictive value 21.6% and negative predictive value 97.8% .

VIII.   Limitations
☐ Study has been conducted over a small study period. Longer period will give better assessment of near miss.
☐ The study could have been done in larger population.
☐ The study has been conducted among mothersattending one academic institution and may suffer from population bias. Hence the result may not be applicable to general population.
☐ The values set in the MEOWS chart are very close to the morbidity range.

IX. Recommendation
Recommendation for further studies
☐ Study to be conducted in different centres in a larger population.
☐ Cut off values of MEOWS to be reconsidered to improve the sensitivity

X.   Conclusion
The present study validates the use of MEOWS in predicting maternal morbidity in the Indian setup. The incidence of maternal near miss was 19% in this study group and was high among illiterate, unbooked and anemic women. Most common cause of maternal near miss was obstetric hemorrhage (75%). The most frequent trigger was pulse rate while the least frequent trigger was pain score. The study on effectiveness of MEOWS chart showed conflicting results. The sensitivity of MEOWS in predicting near miss maternal morbidity was 70%, specificity 84.3%, positive predictive value 21.6% and negative predictive value 97.8% . In our study, MEOWS had more specificity than sensitivity, which minimized unnecessary cost and workload on the residents and staff, also indirectly minimizing the emotional burden on the patient by preventing unnecessary investigations. But a lower sensitivity makes the score less reliable to use as it may miss patients who might be in need of critical care. Further studies to be done to reconsider the cut off values and certain adjustments of the values is needed to improve the sensitivity which can make it applicable in the Indian set up for routine use. Still implementing MEOWS could provide a rich opportunity to standardize care and co ordinate the response to the deteriorating condition.