



## PREDICTION OF MATERNAL MORTALITY USING M-SOFA SCORE IN OBSTETRIC ICU IN A TERTIARY CARE CENTRE

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**ABSTRACT** **Introduction:** M-SOFA stands for 'Modified Sequential Organ Failure Assessment' which describes the clinical course of the patient as a marker of the degree of organ dysfunction. The organ functions used here were pulmonary, cardiac, neurological, haematological, renal and hepatic.

**Methods:** M-SOFA score was used to predict mortality of obstetric patients in intensive care unit. 77 patients were studied taking Day 1 M-SOFA score after admission to intensive care unit. The score and occurrence of survival or mortality of each patient within 4 weeks of admission were analysed.

**Results:** The mortality was high among patients having high M-SOFA score compared with lower scores. Hence it was used as a triage tool to concentrate on sick individuals immediately after admission.

**Conclusions:** M-SOFA score is a great predictor of the severity of illness, especially in very sick patients thereby helping us to triage the cases in a tertiary care centre like ours.

**KEYWORDS :** Intensive Care Unit, M-SOFA SCORE, Maternal Mortality

### INTRODUCTION

Severe obstetric morbidity and mortality constitutes a serious problem worldwide limiting developing countries in reaching the United Nations World Health Organisation Millennium Development Goals. WHO defines maternal mortality as death of a woman while pregnant or within 42 days after delivery, irrespective of pregnancy duration and site, being any cause related with worsening of pregnancy or its management, but not from an accident or an incident case. A limited number of conditions like postpartum haemorrhage, pre-eclampsia, sepsis, obstructed labour account for majority of maternal deaths. Many classification systems have been developed to recognize early deterioration in critically ill patients, some based on sepsis while others were designed to evaluate systemic damage. Similar studies like Acute Physiology and Chronic Health Evaluation (APACHE) and Simplified Acute Physiology Score (SAPS) were conducted. Sequential Organ Failure Assessment is an important scoring system which describes the clinical course of the patient as marker for the degree of organ dysfunction and a predictor of mortality. The organ functions used in this scoring system are pulmonary, cardiovascular, neurological, hepatic, haematological and renal. *The cost of performing SOFA is expensive in our facility and hence we adopted to move towards modified SOFA (M-SOFA) for the respiratory indicator.*

### MATERIAL AND METHODS

**Study Design:** Six months hospital based Retrospective Case Study (Jan 2020 – June 2020)

**Place of Study:** Government Vellore Medical College and Hospital (GVMCH), Adukkamparai, Vellore -11

**Sample Size:** 77 cases were studied retrospectively from cases admitted at obstetric ICU and modified SOFA score was calculated for each patient and the mortality, morbidity and survival of patients were analysed over a period of 4 weeks since admission.

**Table 1 - Modified Sequential Organ Failure Assessment Score**

S. NO	INDICATOR	1	2	3	4
1	Respiration: Sao <sub>2</sub> /Fio <sub>2</sub>	< 400	< 300	< 200	<100
2	Coagulation: Platelet x10 <sup>3</sup>	<150	< 100	< 50	< 20
3	Liver: Bilirubin mg/dl	1.2 - 1.9	2 - 5.9	6-11.9	> 12.0
4	CVS: Hypotension	MAP <70	Dopamine less than	Dopamine more than 5	Dopamine more than

		mmHG	5 or dobutamine*	or epinephrine less than 0.1*	15 or epinephrine more than 0.1*
5	CNS: Glasgow coma scale	13 -14	10 - 12	6 - 9	Less than 6
6	Renal: Creatinine Mg/dl	1.2 - 1.9	2.0 - 3.4	3.5 - 4.9	More than 5.0

**Legend: \*Andrenergic agents administered at least for one hour (doses given µg/kg/min)**

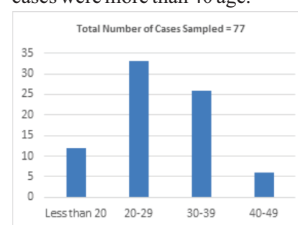
Organ System	SOFA Score	MSOFA Score
Respiratory	PaO <sub>2</sub> /FiO <sub>2</sub> Ratio	SaO <sub>2</sub> /FiO <sub>2</sub> Ratio
Coagulation	Platelet Count x 10 <sup>3</sup> / µL	Same as SOFA Score
Liver	Bilirubin Level, mg/dL	Same as SOFA Score
Cardiovascular	Hypotension or Vasopressors	Same as SOFA Score
Central Nervous System	Glasgow Coma Scale	Same as SOFA Score
Renal	Creatinine, mg/dL or Urine Output	Same as SOFA Score

**PaO<sub>2</sub>/FiO<sub>2</sub> ratio:** Partial pressure of arterial oxygen divided by the fraction of inspired oxygen,

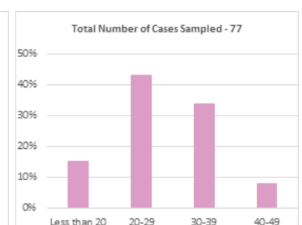
**SaO<sub>2</sub>/FiO<sub>2</sub> ratio:** Arterial Oxygen Saturation measured by a pulse oximeter divided by the fraction of inspired oxygen

### RESULTS:

The results of 77 M-SOFA SCORE CARDS were analyzed. The average obstetrics intake in this facility is around 1450. Off the cases taken for study most patients were in the age group 20-29 (43%) and 6 cases were more than 40 age.



**Fig-1: Age Group vs Impacted Cases**



**Fig -2: Age Group vs Percentage Cases**

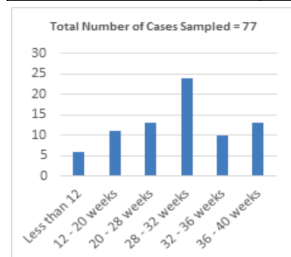
**Table No. 2 - Age Characteristics Of Population Taken**

Age group in years	Number of Cases	Percentage
Less than 20	12	15%
20-29	33	42.9%
30-39	26	33.7%
40-49	6	7.8%

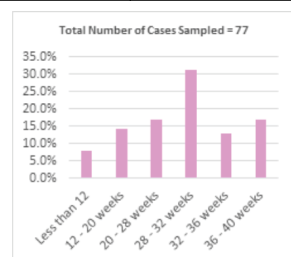
Most of the cases were 28 – 32 weeks gestation followed by 16.8% cases in 20 -28 weeks and 36 - 40 weeks and less than 12 weeks only 7% of cases.

**Table No. 3 - Resolution of Pregnancy at Gestational Age**

Gestational Age in weeks	Number of Cases	Percentage
Less than 12	6	7.8%
12-20	11	14.2%
20-28	13	16.8%
28-32	24	31.1%
32-36	10	12.9%
36-40	13	16.8%



**Fig-3: Gestational Age vs Impacted Cases**

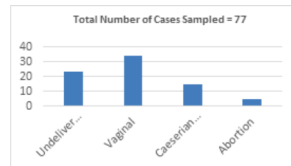


**Fig - 4: Gestational Age vs Percentage**

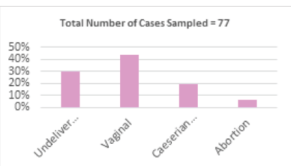
When the delivery outcome was noted most of them vaginal delivery was 44%, Caesarean section were 20%, abortions 7% and rest 30% was undelivered.

**Table No. 4 - Type Of Delivery**

Type of Delivery	Number of Cases	Percentage
Undelivered	23	30%
Vaginal	34	44%
Caesarean section	15	19.4%
Abortion	5	6.4%



**Fig - 5: Type of Delivery vs Impacted Cases**



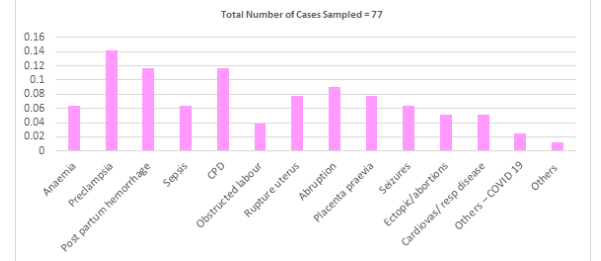
**Fig - 6: Type of Delivery vs Percentage**

Among the 77 cases studied, the primary risk factors that created a near miss situation were identified. In some cases, there were more than one secondary risk factor. The highest percentage was Preeclampsia accounting for 15% followed by PPH and cephalopelvic disproportion each 12%, anaemia, sepsis, seizures each 6.4%. Antepartum haemorrhage 9.0% and placenta praevia contributed 11.6%. Rupture uterus around 8% mainly referred cases were identified. Cardiovascular diseases and ectopic pregnancy each contributed around 5%. Two cases of COVID-19 were noted during the study, one cases presented with severe abruption with MODS and expired and Other survived.

**Table No. 5 - Primary Determinant Factor For Near Miss Condition**

Primary Risk Factor	Number of Cases	Percentage
Anaemia	5	6.4%
Preeclampsia	11	14.2%
Post partum haemorrhage	9	11.6%
Sepsis	5	6.4%
CPD	9	11.6%
Obstructed labour	3	3.8%
Rupture uterus	6	7.8%
Abruption	7	9.0%

Placenta praevia	6	7.8%
Seizures	5	6.4%
Ectopic/abortions	4	5.1%
Cardiovascular/Resp disease	4	5.1%
Others – COVID 19	2	2.5%
Others	1	1.2%

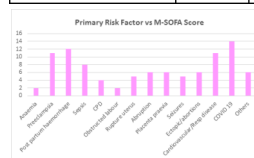


**Fig – 7: Primary Risk Factor vs Percentage**

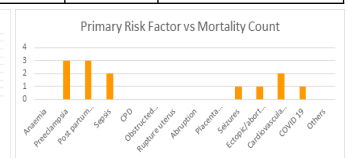
M-SOFA score was calculated by adding all the 6 parameters namely respiratory, cardiac, neurological, haematological, hepatic and renal. Among the primary risk conditions anaemia, CPD, obstructed labour, Rupture uterus, placenta praevia did not have fatality. Anaemia was managed with adequate blood transfusion, CPD and obstructed labour through meticulous partogram, rupture uterus by early suspicion and identification by expert assistant professors and finally placenta praevia was managed by prophylactic Dr. Ashok Anand sutures. The leading condition of mortality with M-SOFA score more than 9 is Preeclampsia due bad and late referrals from all over districts, followed by sepsis with M-SOFA SCORE above 8 and PPH with M-SOFA SCORE more than 6. Cardiovascular cases are with-M SOFA scores reaching up to 7. Ectopic pregnancies rarely contribute to mortality unless they are brought in a shocked state. One case of COVID-19 with highest score was noted during this pandemic time who expired on the same day after admission due abruption.

**Table No. 6 - Primary Risk Factors For With M- Sofa Score And Mortality Analysis For All 77 Cases**

Primary Risk Factor	Number of Cases	No of Mortality	M-SOFA Score	MORTALITY at M-SOFA
Anaemia	5	0	0 - 2	No fatality
Preeclampsia	11	3	2 – 11	9 and above
Post partum haemorrhage	9	3	0 - 12	6 and above
Sepsis	5	2	0 - 8	8 and above
CPD	9	0	0 - 4	No Fatality
Obstructed labour	3	0	0 - 2	No Fatality
Rupture uterus	6	0	1 – 5	No Fatality
Abruption	7	0	1 – 6	6 and above
Placenta praevia	6	0	3 - 6	No Fatality
Seizures	5	1	1 - 5	5 and above
Ectopic/abortions	4	1	2 - 6	6 and above
Cardiovascular/Resp disease	4	2	2 - 11	7 and above
Others – COVID 19	2	1	14	14 and above
Others	1	0	6	6 and above



**Fig - 8: Primary Risk Factor vs Score**

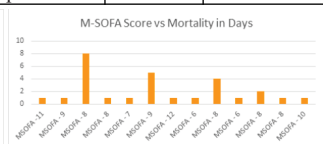


**Fig - 9: Primary Risk Factor vs Mortality Count**

Among the 13 cases of mortality one case of Covid-19 had the highest score of 14, expired same day due to severe abruption and multi organ failure. One case of eclampsia had a score of 10 and died same day. One case of PPH had score 8 and had irreversible shock. Another case of peripartum cardiomyopathy had score 11 and died in one day. The other causes of mortality with scores ranging from 6 - 9 were abruption, ectopic pregnancy, cardiac disease. The patient with M-SOFA score greater than 6 posed a high risk of fatality.

**Table 7: M-softa Score And Mortality Days Among 13 Cases Of Mortality: Jan-June 2020**

Primary Risk Factor	Cause of death	M-SOFA Score	Mortality In Days
Cardiac disease	Peripartum cardiomyopathy	11	1
Post partum collapse	Amniotic embolism	9	1
Cerebral venous thrombosis	Subdural haemorrhage with MODS	8	8
Post partum haemorrhage	Hypovolemic shock with DIVC	8	1
Cardiac disease	Ectopic with Mitral valvular disease	7	1
Severe Pre Eclampsia	Acute pulmonary edema	9	5
Post partum haemorrhage	Atonic pph with irreversible shock	12	1
Severe Preeclampsia	Abruption with Hellp and DIVC	6	1
Cerebrovascular accident	CVA with brainstem haemorrhage	8	4
Post partum hemorrhage	Atonic pph	6	1
Sepsis	IUD with AKI	8	2
Eclampsia	Abruption with AKI - Covid -19	14	1
Eclampsia	Eclampsia with Abruption	10	1

**Fig - 10: Cause of Death vs M-SOFA Score****Fig - 11: M-SOFA Score vs Mortality in Days**

## DISCUSSION

APACHE, SAPS and MPM are primary prognostic models and are widely used scoring systems. The newer scoring systems include SOFA and multi-organ dysfunction scores (MODS) and are the organ dysfunction scores which may be measured repeatedly at fixed time intervals. They have an ability to capture the dynamic nature of clinical condition of the patient unlike the prognostic models. This system includes six major organ systems (pulmonary, hematologic, hepatic, cardiovascular, central nervous, and renal), records the most deranged value on each day, and scores the derangement from 0 (normal) to 14 (most deranged). SOFA scores can be taken daily or on a 48hr basis. The best correlation of scores with the outcome in terms of morbidity and mortality is seen with maximum SOFA score and M-SOFA score.

The Primary Risk Factors assessed in the sampled cases include Anaemia, Preeclampsia, Postpartum Haemorrhage, Sepsis, CPD, Obstructed Labour, Rupture Uterus, Abruption, Placenta Praevia, Seizures, Ectopic/abortions, Cardiovascular/Respiratory Disease, COVID 19 Positive and Others

The present study reflects a strong correlation of mortality with SOFA scores on day 1 which denotes that SOFA score at the time of admission can be used to quantify the degree of dysfunction/failure already present on ICU admission and can predict the future course of treatment. Hence, initial SOFA score can triage the patients into risk categories for further management and resource planning. The highest M-SOFA score can identify the critical point at which patients exhibit the highest degree of organ dysfunction during their stay. In our study, we found that there is a strong correlation of maximum SOFA score with mortality outcome.

The mean M-SOFA score indicates the average degree of organ failure over time. We correlated the mean score with mortality. The mean SOFA score in survivors was less than 6. Ferreira *et al.*<sup>[1]</sup> also concluded that the mean SOFA score had a better prognostic value than the other SOFA derived variables. They opined that this may be because patients who present with a limited degree of organ dysfunction and have a long ICU stay still have a high likelihood of survival.

The cause of death in the assessed cases with M-SOFA score greater than 6 ranged in the following categories - Peripartum Cardiomyopathy, Amniotic embolism, Subdural haemorrhage with MODS, Hypovolemic shock with DIVC, Ectopic with Mitral Valvular Disease, Acute Pulmonary Edema, Atonic pph with Irreversible shock, Abruption with Hellp and DIVC, CVA with Brainstem Haemorrhage, Atonic pph, IUD with AKI, Abruption with AKI - Covid -19 and Eclampsia with Abruption

## CONCLUSION

The total maximum M-SOFA score proved capable of evaluating the severity and prognosis of this patient population, and its discriminatory power appears not to have been affected by the physiological modifications of pregnancy. The evaluation of organ dysfunction/failure according to maximum M-SOFA score is simple, easily standardized, and requires only low-complexity laboratory resources. From our study, M-SOFA score was mainly helpful in triaging Preeclampsia patients with complications and managing the same. The average M-SOFA score of 6 and above implied a high risk of fatality. The combination of COVID-19 positive condition proved to be an imminent risk of fatality due to associated respiratory complications with a very high M-SOFA score of 14. M-SOFA score greater than 10 posed an accelerated rate of fatality within 1 to 3 days of admission than in comparison fatality at M-SOFA scores between 6 and 10 ranging over 7 days of admission.

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