

ORIGINAL RESEARCH

An observational study on correlation of modified SOFA (mSOFA) score in prediction of maternal morbidity and mortality in pre eclampsia patients

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ABSTRACT

Background: Preeclampsia is one of the dreadful complication of pregnancy, a leading cause of maternal morbidity and mortality. To assess organ dysfunction clinically a Sequential Organ Failure Assessment Score (SOFA score) was developed. This study was done with the objective of correlation of maternal mortality and morbidity in pre eclampsia patients using modified SOFA (mSOFA) score. **Methods:** This was a prospective study which was carried out for a period of 1 year in the Department of obstetrics and gynaecology in a tertiary care Medical college hospital. The study enrolled a total of 100 patients. A structured Proforma was used to collect the relevant data and detailed history was taken. Duration of hospital stay, maternal and perinatal outcomes, maternal complications such as abruption, DIC, HELLP, Sepsis, eclampsia, maternal mortality were observed and assessed. **Results:** The average age was 30 yrs and most of them were >37 weeks of gestation. Anaemia was the most common comorbidity among them. The mortality rate was 12%. The greater the score the more were the complication and also the need for hospital stay. The study inferred a significant association between the mSOFA score and maternal mortality and complications of preeclampsia like abruption, eclampsia. **Conclusion:** The difference in the mSOFA score in the pre eclampsia patients were assessed in this study. The mortality and the morbidity increases with increase in the SOFA score. So it can be concluded that obstetrically modified SOFA scores has an increased significance and predictability of mortality in pre eclampsia patients.

Keywords: modified SOFA score, mSOFA, pre eclampsia, maternal mortality, ICU stay.

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INTRODUCTION

Preeclampsia is one of the most common cause of maternal morbidity and mortality worldwide. It complicates about 2-5 % of all pregnancies globally. Maternal mortality due to preeclampsia is 4-6%¹. In India, the incidence of pre eclampsia is reported to be about 8-10% among the pregnant women. Globally every year according to FIGO 2021 and NICE guidelines about 76000 (10%) maternal deaths, 20.5% of near MSS cases and 5,00,000 fetal deaths are caused due to preeclampsia. Failure to diagnose early and initiate treatment results in multiorgan failure and hence increases the need for ICU admission and

monitoring. Likewise neonatal complications and NICU admissions are high in babies born to preeclamptic mothers.

Till date, in pre eclampsia patients, the assessment of the organ failure is difficult. Obstetrical morbidity-mortality scale which is worldwide accepted continued to be lacking. Many classification systems were used for early recognizing of organ dysfunction and early detection of clinical deterioration in patients admitted in ICU. Some were based only on the sepsis², whereas the other systems were designed to evaluate the systemic damages also³.

An important scoring system is the Sequential Organ Failure Assessment (SOFA) which is being used nowadays that briefs the patient's clinical course and is an indicator of organ dysfunction. This can be used as the predictor for mortality and morbidity.

The organ system which are assessed in the scoring system include the pulmonary, cardiovascular,

coagulation, hepatic, renal, neurological⁴. The altered immunological and physiological changes in pregnancy should be considered during assessment and further management. The altered responses are taken into account and a new score has been proposed – mSOFA (Obstetrically modified Organ Failure Assessment score

MODIFIED SOFA SCALE⁵

Organ system	0	1	2	3	4
Respiration PaO ₂ /FiO ₂ (mm Hg)	> 400	< 400	< 300	< 180	< 100 < 67
Respiration PaO ₂ /FiO ₂ (mm Hg)		221-301	142-220	67-141	<67
Coagulation Platelets (10 ³ /mm ³)	> 150	< 150	< 100	< 50	< 20
Liver Bilirubin (mg/dl)	< 1.2	1.2–1.9	2.0–5.9	6.0–11.9	> 12.0
Cardiovascular Hypotension	No hypotension	MAP < 70	Dopamine ≤ 5 or dobutamine (any)	Dopamine > 5 or NE ≤ 0.1	Dopamine > 15 or NE > 0.1
CNS Glasgow Coma Score	15	13–14	10–12	6–9	< 6
Renal Creatinine (mg/dl) or urine output (mL/d)	< 1.2	1.2–1.9	2.0–3.4	3.5–4.9 or < 500	> 5.0 or < 200
Sepsis	absent	absent	absent	present < 12 hours	present > 12 hours

This study was done with the objective of correlation of maternal mortality and morbidity, hospital stay in pre-eclampsia patients using modified SOFA score.

MATERIALS AND METHODS

The observational non randomized study was done in the Department of obstetrics and gynaecology at a tertiary care medical college hospital during the period October 2021 to September 2022. Sample size was calculated Using OpenEpi Version 3.01, the minimum sample size was calculated to be 100. After obtaining approval from the Institutional Ethical committee the study was started. Each participant of the study were well briefed about the study and an informed written consent was obtained.. 100 pre-eclamptic patients admitted in ICU after evaluating the inclusion and exclusion criteria were included in the study.

Inclusion criteria were preeclamptic patients admitted in ICU willing to participate in the study. Patients with Chronic hypertension, and those with neurological dysfunction, liver failure, renal disorders, lung disease, coagulation disorders were excluded from the study.

A common proforma with regard to the history and clinical examination was formulated.. History

regarding age, socioeconomic status, occupation, marital period, History of comorbidities were obtained from the patient.. Clinical examination included anthropometric measurements, checking for pulse rate, BP, SPO₂, obstetric examination and obstetric ultrasound. The complications observed in the mother were abruption, eclampsia, DIC, HELLP, Sepsis, and mortality. Prematurity, birth weight, neonatal deaths were the perinatal outcomes measured.

Data were entered in Microsoft excel and analysed using SPSS version 23. Descriptive statistics is given by mean, SD, percentage, frequency and graphs. Analytical statistics is given by chi-square test, to find the association between outcome i.e., SOFA score and other associated factors. P-value<0.05 is considered to be significant throughout the study.

RESULTS

In our study 62% of the patients were in the age group 20-35 yrs, 15% were < 20yrs and 23% were >35 yrs and the average age was 30 yrs.

With regard to the gestational age (GA) 55 patients had a GA of >37 weeks, 26 patients were between 34 – 37 weeks and 18 patients were <34 weeks . Out of the 100 antenatal mothers 56 were primigravida and 44 were multigravida. About 88% of the patients delivered via Lower Segment Caesarian Section (LSCS), 12% by labour natural. 53% of our study population had associated anaemia complicating pregnancy.

Ventilatory support was required in 32 out of the 100 patients (Fig1). 24 out of the 100 patients had eclampsia . 8 % of the patients went in for DIC (Fig2) and 22 out of 100 patient had abruption. Overall 12 patients expired while 88 recovered completely .

mSOFA score was assessed individually for each organ function. Among the individual components of respiration, coagulation, hepatic, cardiovascular and CNS derangements The worst affected was

Coagulation profile with low platelet count (8% had a score of >3 -Fig 3) followed by hepatic derangement (4% had a score of >3 -Fig 4) which was followed by CNS affection (2% had a score >3 - Fig 5) . Total mSOFA score has maximum specificity than the individual score. The study inferred that total mSOFA score is a useful tool to predict the mortality and morbidity in pre eclamptic mothers admitted in obstetric ICU. The higher the score the poorer the prognosis with a high mortality rate . Most of the patients had a modified SOFA score 0,1,and 2 in our study. 46% of the patients had a score 0, 9% had a score 1, 19.2% had a score 2. And rest 25.2% of the patients had a score >3. The patients who had a score of >6 had less duration of hospital stay due to mortality, those who had a score of < 6 had a longer duration of hospital stay (Fig 6).

Fig 1: Incidence of patients who required ventilatory support

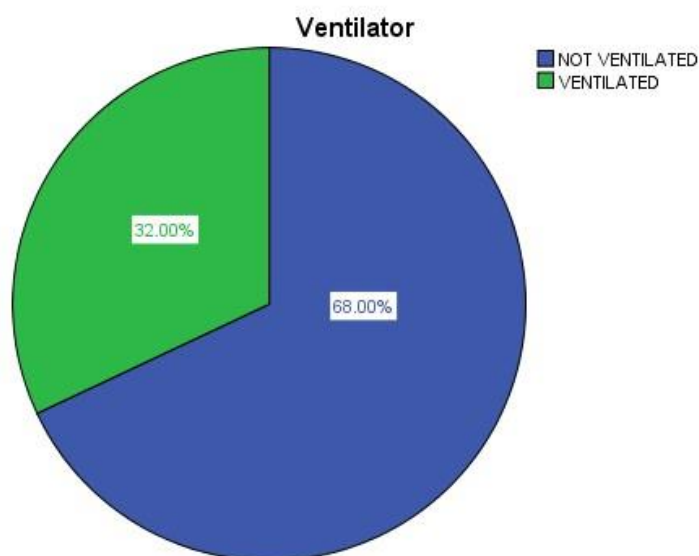


Fig 2: prevalence of Disseminated intravascular coagulation (DIC) among the study population

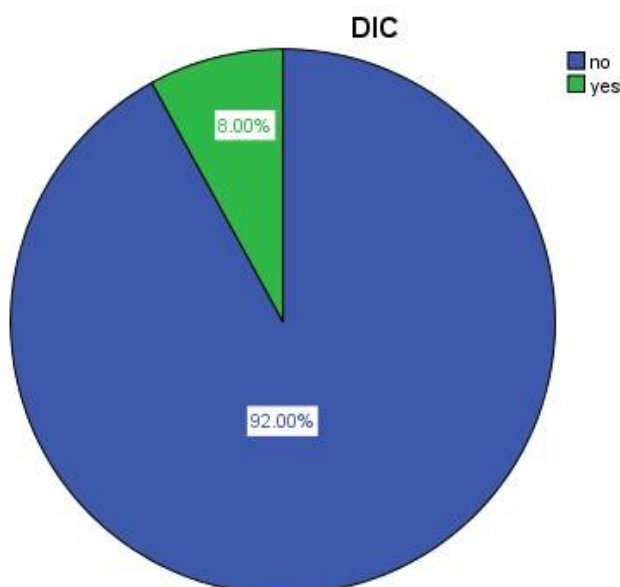


Fig 3: Modified SOFA score with regard to coagulation [platelets ($10^3/\text{mm}^3$)]

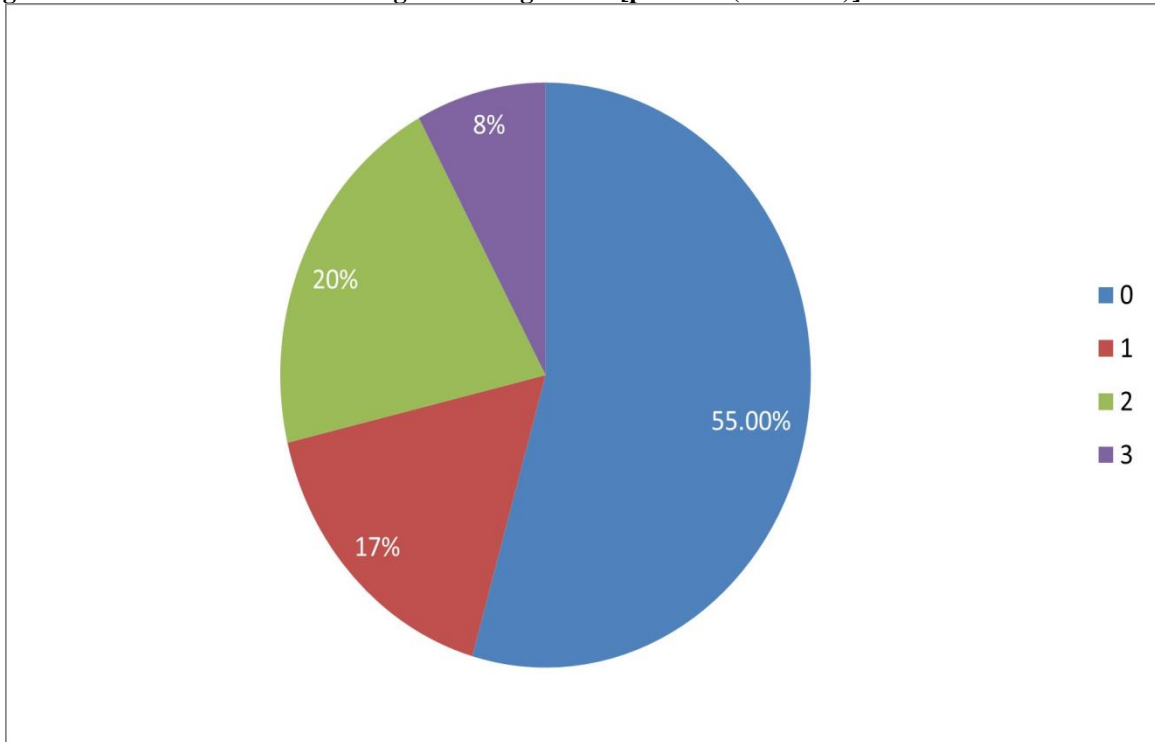


Fig 4: Modified SOFA score with regard to Hepatic derangement

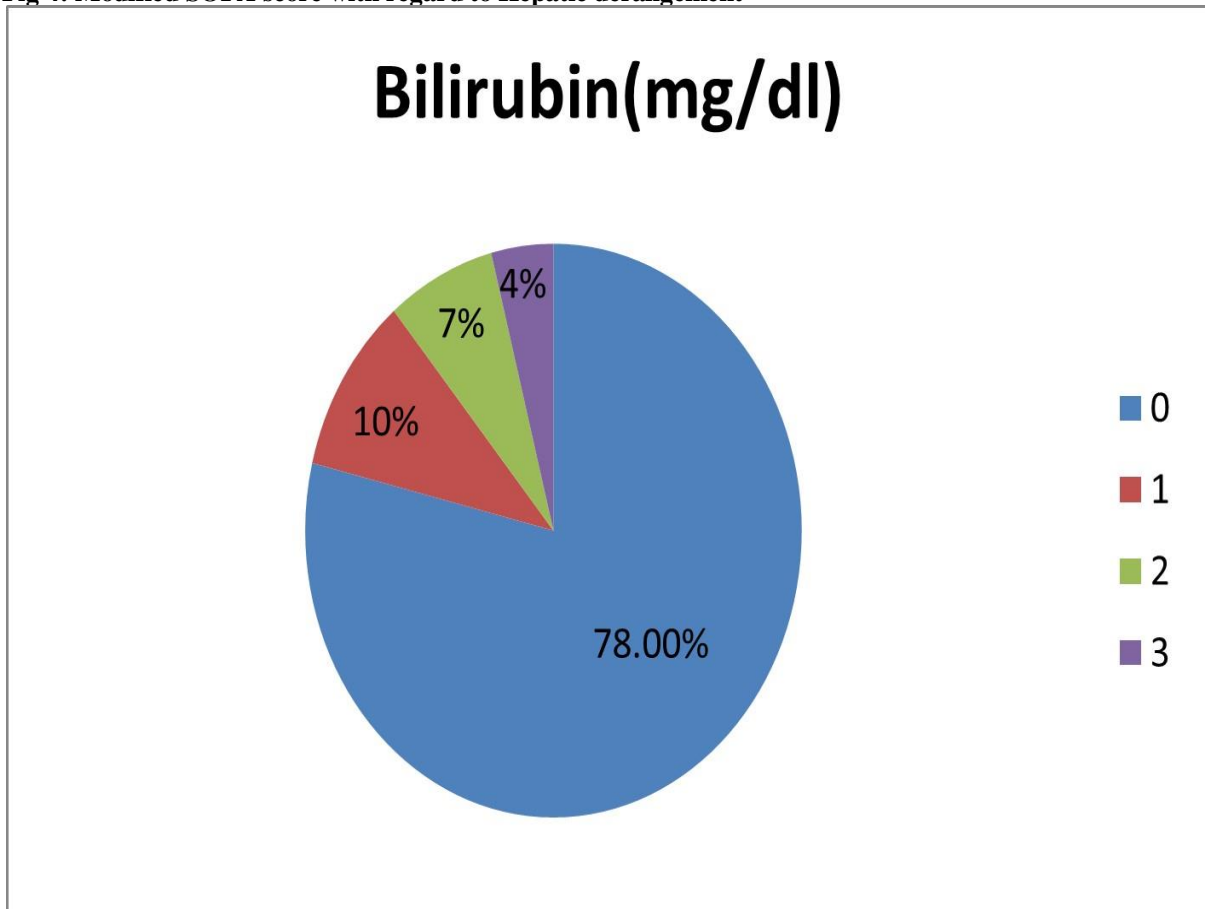


Fig 5: Modified SOFA Score with regard to Central nervous system (Glasgow Coma Scale)

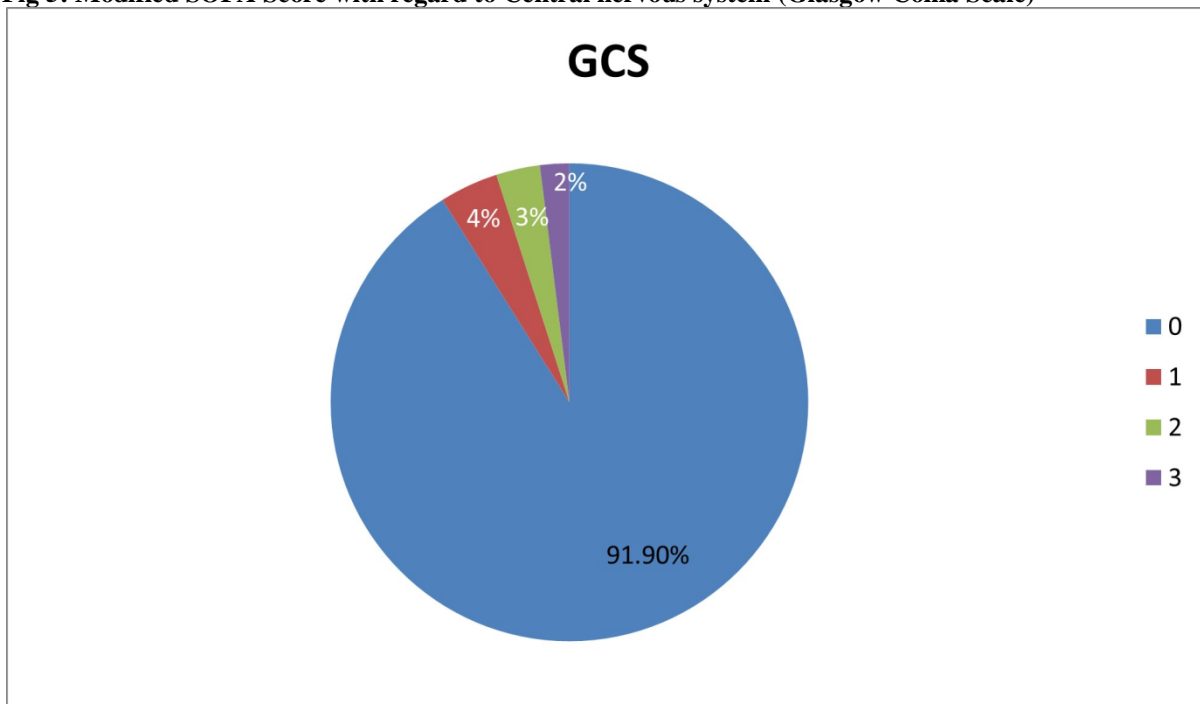
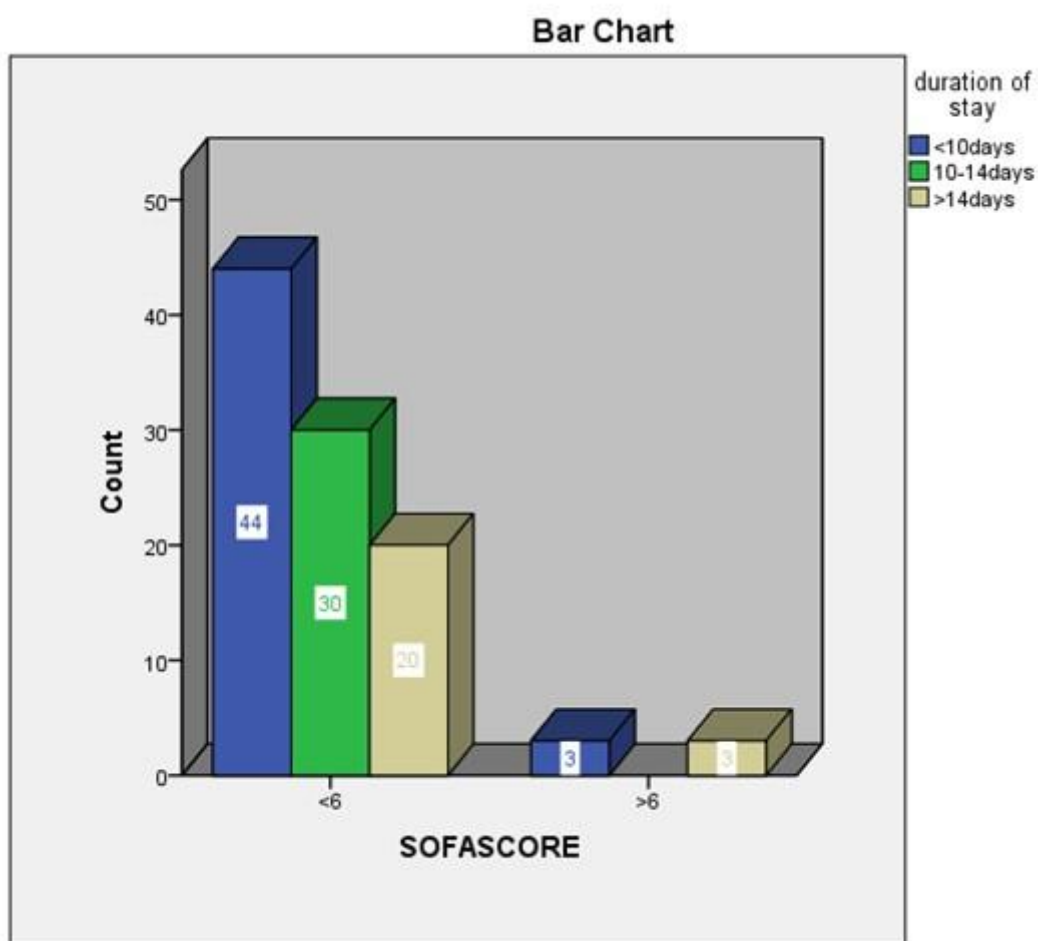


Fig 6: Comparison between SOFA score and duration of hospital stay



Our study inferred a significant association between maternal mortality and SOFA score with p-value <0.05, i.e., 0.006. The mortality was high in patients with sofa score >6 when compared to patient with mSOFA score

<6 (Table 1).

Table 1: Correlation of maternal mortality and mSOFA score

Cross tab					
			Maternal death		Total
			Dead	Alive	
mSOFA score	<6	Count	0	0	6
		% within mSOFA score	0	0	
	>6	Count	12	88	94
		% within mSOFA score	6.4	93.6	100
Total		Count	12	88	100
		% within mSOFA score	12	88	100

There is a significant association between maternal death and mSOFA score with p-value <0.05, i.e., 0.006. This study shows a high significance value in people with mSOFA score >6 end up dying compared with people with mSOFA score <6.

Also 22 patients out of 100 with SOFA score >6 had eclampsia and 2 people with mSOFA score <6 had eclampsia which was statistically significant with p-value <0.005, i.e, 0.02 (Table 2)

Table 2: Comparison of Eclampsia and mSOFA score

			Eclampsia		Total
			no	yes	
mSOFA score	<6	Count	72	22	94
		% within mSOFA score	76.6%	23.4%	100.0%
	>6	Count	4	2	6
		% within mSOFA score	66.7%	33.3%	100.0%
Total		Count	76	24	100
		% within mSOFA score	76.0%	24.0%	100.0%

22 people out of 100 with mSOFA score<6 had eclampsia and 2 people with mSOFA score>6 had eclampsia which was statistically significant with p-value <0.05, i.e, 0.02.

22 % of the people had abruption in this study. On correlating mSOFA score and abruption, there is a significant difference with p-value <0.05, i.e, 0.02 (Table 3).

Table 3: Comparison of mSOFA score and abruption

			Abruption		Total
			no	yes	
mSOFA score	<6	Count	73	21	94
		% within mSOFA score	77.7%	22.3%	100.0%
	>6	Count	5	1	6
		% within mSOFA score	83.3%	16.7%	100.0%
Total		Count	78	22	100
		% within mSOFA score	78.0%	22.0%	100.0%

There is significant difference between mSOFA score and abruption with p-value<0.05, 0.02

In our study, 96% of the patient with mSOFA score <6 had no sepsis, 3 patient with a mSOFA score >6 had sepsis which was statistically significant with p- value <0.05,i.e, 0.002.(Table 4).

Table 4: Comparison of mSOFA score and sepsis

			Sepsis		Total
			NO Sepsis	Sepsis	
mSOFA score	<6	Count	91	3	94
		% within mSOFA score	96.8%	3.2%	100.0%
	>6	Count	4	2	6
		% within mSOFA score	66.7%	33.3%	100.0%
Total		Count	95	5	100
		% within mSOFA score	95.0%	5.0%	100.0%

96% of the population with mSOFA score <6 had no sepsis, 3 people had sepsis, and 2 people with mSOFA score >6 had sepsis which was statistically significant with p-value<0.05, 0.002.

Table 5: Comparison between mSOFA score and duration of hospital stay

		Duration of stay			Total	
		<10days	10-14days	>14days		
mSOFA score	<6	Count	44	30	20	94
		% within mSOFA score	46.8%	31.9%	21.3%	100.0%
	>6	Count	3	0	3	6
		% within mSOFA score	50.0%	0.0%	50.0%	100.0%
Total		Count	47	30	23	100
		% within mSOFA score	47.0%	30.0%	23.0%	100.0%

In our study, most of the people with mSOFA score <6 had more duration of hospital stay and people with mSOFA score >6 had lesser duration of hospital stay as it has higher mortality rate with mSOFA score > 6, which was statistically significant with p-value <0.05 i.e., 0.003.

About 55% of our study population had score 0 with platelets count of > 150000, 17% had score 1 with platelet count of < 150000, about 20% had score 2 with platelet count of < 100000 and about 8% had score 3 with platelet count of <50000 (Fig 3). In our present study, about 91% of our study population belong to score 0 with GCS-15, 2% belong to score 3 with poor GCS 6-9.

DISCUSSION

The study was conducted over a period of one year and observed organ dysfunction and failure in 100 pre eclamptic patients admitted to obstetric ICU. Our study reported a mortality rate of 12%. Our study inferred a significant association between mSOFA score and maternal mortality, sepsis with a significant p value of 0.006, 0.002 respectively.

Many scores which are similar to mSOFA but focused mainly on sepsis⁶ are Multiple Organ Dysfunction Score (MODS) and Brussels Score⁶. These scores differs in the definition of cardiovascular dysfunction/ failure^{7,8}. In the mSOFA score, the requirements for adrenergic support defines the cardiovascular dysfunction/failure. The physiological parameter which is adjusted here is PaO₂/FiO₂.

The APACHE II and SAPS II scores are commonly used in obstetric ICUs but study by Neel et al used maximum SOFA score because of the ease of the calculation and ability to analyze the entire process of pathophysiology of organ dysfunction in pregnancy complications⁹ which concurs with our study.

Our study also infers the same as Ray et al study which compared SOFA, mSOFA and and inferred that modified SOFA score has increased the predictability of mortality in obstetric patients than the traditional SOFA score¹⁰

Jonguitud et al compared APACHE II, SOFA, APACHE II-M, O-SOFA scores and maternal mortality in patients admitted with co morbidities. The most common cause of admission in ICU was hypertensive disorders in pregnancy (50 cases). This study found a favourable tendency towards APACHE

II-M score to predict the prognosis of mortality in women which contradicts with our study¹¹ Also in the cohort study conducted Rojas et al stated that admissions due to hypertensive disorders predominate in obstetric ICU and they were the main causes of death.¹²

Nakimuli et al conducted a study on the burden of maternal mortality and morbidity attributable to hypertensive disorders in pregnancy. This study suggested further studies should evaluate and validate risk prediction models for adverse outcomes and prognostic factors using morbidity indices and mSOFA scores¹³ Agarwal et al stated that mSOFA was superior to SOS to decide critical care admission and predict mortality in pregnancy- associated sepsis in a population with severe morbidity¹⁴

Anand et al study shows that the total mSOFA score had good predictive and discriminative value for survival or death in critically ill obstetric patients¹⁵. The limitation of our study is that it being a single centre study with a small number of patients the hence predictability may have been affected.

CONCLUSION

The difference in the modified SOFA score and its correlation in pre eclampsia patients in a tertiary care setting who received intensive care were assessed in this study. The influence of physiological changes in an obstetric patient renders it difficult to establish reference values for the scales which are in use already. Encouraging results were obtained with the mSOFA that we used here when compared with the SOFA scale. It is one among the worldwide-acceptable prognostic scale used in obstetric patients. The mortality and the morbidity in pre eclampsia patients admitted in ICU increases with increase in the mSOFA score.

The modified SOFA score throughout the ICU stay is evaluated and is a good prognostic indicator. High survival rate is seen in the patients with limited degree of organ dysfunction.

From this study results, we concluded that the predictability of mortality in pre eclampsia patients has been increased with the use of obstetrically modified SOFA scores

Complications of preeclampsia can be avoided if the women is screened with basic risk scoring model during her initial visit and the earlier commencement

of prophylactic intervention is done^{16,17}. This study inferred that modified SOFA score had robust diagnostic powers to predict mortality and morbidity in pre eclampsia patients.

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DECLARATIONS

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Conflict of interest: Nil

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