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Original Article

Obstetrics and Gynaecology Section

Assessment of Clinical Profiles of the Obstetric Patients Admitted to ICU in a Tertiary Care Hospital, Madhya Pradesh, India: A Longitudinal Study

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ABSTRACT

Introduction: Management of critically ill obstetric population admitted to Intensive Care Unit (ICU) remains a significant hurdle in developing countries.

Aim: To examine demographic characteristics, diagnoses, clinical outcomes, and performance of modified Sequential Organ Failure Assessment (SOFA) score between survivors and non survivors in all obstetric admissions to the ICU.

Materials and Methods: This was a longitudinal study conducted in a 12-bedded obstetric ICU at 850 bedded Netaji Subhash Chandra Bose Medical College, Madhya Pradesh, India from March 2016 to August 2017. Clinical profile and outcomes of ICU patients were analysed for total 367 obstetric ICU admission. To determine mortality outcomes of the study population, a modified SOFA score was used to take into account physiological changes in pregnancy. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 15.0 (Inc., Chicago, Illinois, USA). Receiver Operating Characteristics (ROC) curve analyses of SOFA score as a predictor of mortality, and optimum cut-off point value was determined.

Results: The mean age of the study population was 24.7±4.0 years. Eclampsia (35.7%) and preeclampsia (13.62%) were the leading indications of admission. The survival of patients was associated significantly with low SOFA scores with mean SOFA score of 6.48±2.804 among survivors and 10.42±3.579 among non survivors (p-value=0.001).

Conclusion: Eclampsia and preeclampsia were the leading cause of ICU admission, that can be preventable. Higher SOFA score was related to higher mortality in the obstetric patients requiring ICU.

Keywords: Intensive care unit, Maternal mortality, Obstetric complications, Sequential organ failure assessment score

INTRODUCTION

Treatment of severely ill obstetric patients at an Intensive Care Unit (ICU) poses a great challenge to both obstetrician and ICU physician. The management of these patients is hindered due to the following obstacles [1,2]:

A) altered maternal physiology,

B) concerns about foetal viability,

C) rapid deterioration of maternal and foetal health in any incident, and

D) care of two lives with two distinct physiologies at the same time.

Admission of these patients prevails 0.1-0.9% of deliveries with overall mortality ranged from 3.4-21% [3]. Furthermore, the incidence of obstetric patients admitted to ICU is high in developing countries (0.13-4.6%) than developed countries (0.08-0.76%). In these patients, maternal mortality rates are higher in developing countries (2-43.63%) as compared to those in developed countries (0-4.9%) [4,5]. Globally hypertensive disorders of pregnancy complicate approximately 5-10% of pregnancies [3,4].

Preeclampsia/eclampsia remains one of the most common causes of maternal mortality worldwide as 12% of all maternal deaths are caused by eclampsia [6,7]. Ten percent of women have high blood pressure during pregnancy, and preeclampsia complicates 2-8% of pregnancies [8]. Severe consequences such as abruptio placentae, thrombocytopenia, disseminated intravascular coagulation, pulmonary edoema, and aspiration pneumonia were shown to be 3-fold to 25-fold higher in women with preeclampsia and eclampsia. Almost all patients admitted to ICU are anaemic [9]. Varieties of observational studies have established an association between anaemia's and worsen outcomes including mortality, failure to wean from mechanical ventilation and myocardial infarction [10-12]. In obstetric patients, a number of traditional ICU scoring systems has been used to determine the severity of illness and maternal mortality [13-15], and most of these scores have some differences in sensitivity and specificity as regards the prediction of morbidity and mortality [16,17]. The Sequential Organ Failure Assessment (SOFA) score determines the degree of organ dysfunction and prognosis of illness severity. Moreover, the SOFA scoring system can be applied in a low infrastructure setting like ours due to the fact that it consists of few variables that are routinely measured [18].

Despite the high mortality rates of obstetric patients admitted to ICU in developing countries, there remains a paucity of data of these patients in developing countries. In the light of the foregoing, the present study was envisaged to examine demographic characteristics, diagnosis on admission and the clinical outcomes in terms of morbidity and mortality. The performance of modified SOFA scoring system between survivors and non survivors in all obstetric admissions to the ICU was also assessed.

MATERIALS AND METHODS

This was a longitudinal study conducted in a 12-bedded obstetric ICU at 850 bedded Netaji Subhash Chandra Bose Medical College, Madhya Pradesh, India from March 2016 to August 2017. The study was approved by Institutional Ethics Committee (approval number: NSCBMC/08/02/15) and adhered to the tenets of the Declaration of Helsinki. All patients gave written informed consent form.

Inclusion and Exclusion criteria: A total of 367 obstetric patients admitted to ICU during pregnancy or within 6 weeks of delivery were included in the study. Those patients who fulfilled the criteria for admission to ICU according to the National Health Mission guidelines [19] were included in the study and those patients who did not fulfill any of the criteria were excluded from the study.

Study Procedure

Information regarding demographic characteristics, socio-economic status using the scale proposed by Kuppuswamy scale [20], indications/causes for admission to the ICU, complications during their stay and interventions, maternal outcomes (in terms of death, improved and discharged), and length of ICU stay were collected. The patients were divided into two groups on the basis of mortality:

- Survivors
- Non survivors

A modified SOFA score was used to determine mortality outcomes of the obstetric patients admitted to the ICU [21]. It measures bilirubin, creatinine, platelet count, PaO_2/FiO_2 ratio (i.e., ratio of arterial oxygen partial pressure to fractional inspired oxygen), Glasgow Coma Scale (GCS) score, and Mean Arterial Pressure (MAP) value. Each parameter is rated from 0 (physiological function) to 4 (worst values) at predetermined intervals, resulting in a total score of 0-24 points.

STATISTICAL ANALYSIS

Continuous variables were calculated as mean±standard deviation. Categorical variables were reported as frequency and percentages. The study groups were compared using Chi-square test or Fischers-exact test for the categorical variables. A p-value <0.05 was considered statistically significant. All statistical analyses were conducted with the help of statistical software Statistical Package for Social Sciences (SPSS), version 15.0 (Inc., Chicago, Illinois, USA). Receiver Operating Characteristics (ROC) curve analyses of SOFA score as a predictor of mortality, and optimum cut-off point value was determined.

RESULTS

The mean age of the study population was 24.7±4.0 years. Majority of the patients were in age group of 20-25 years (60.2%). According to Antenatal Care (ANC) registration, majority of the patients were uncooked (99.5%), primigravida (58%) and low socio-economic status (90.2%), and referred from rural areas (64.3%) [Table/Fig-1].

Characteristics	Number of patients, %
Age wise distribution, years	
<20	10 (2.7%)
20-25	221 (60.2%)
26-30	102 (27.8%)
>30	34 (9.3%)
Mode of admission	
Elective (booked)	2 (0.5%)
Emergency (un booked)	365 (99.5%)
Residential area	
Rural	236 (64.3%)
Urban	131 (35.7%)
Education status of the head of the household	
Illiterate	219 (59.7%)
Primary education	110 (30%)
Secondary education	20 (5.4%)
Graduate	18 (4.9%)
Occupation of the head of the household	
Unemployed/Unskilled labourer	210 (57.2%)
Semi-skilled/Skilled	105 (28.6%)
Clerical/shop owner/landowner/semi-professional	32 (8.7%)
Profession	20 (5.4%)
Monthly family income, rupees	
≤1000	290 (79%)
>1000-5000	65 (17.7%)
>5000-10000	12 (3.3%)
Socio-economic status* [20]	
Low**	331 (90.2%)
Middle***	36 (9.8%)
Referred from outside	210 (57.2%)
Parity	
Primigravida	213 (58%)
Multigravida	154 (42%)
Religion	
Hindu	350 (95.4%)
Muslim	17 (4.6%)

[Table/Fig-1]: Demographic characteristics of the study population (N=367).
**score≤10; ***score≤25

Blood and blood component therapy (27.5%), magnesium sulphate therapy (21.8%) and mechanical ventilation (17.2%) were the most frequent interventions [Table/Fig-2].

Interventions in patient	Number of patients, %
Blood transfusion	101 (27.5%)
Magnesium sulphate therapy	80 (21.8%)
Mechanical ventilation	63 (17.2%)
Fresh frozen plasma	55 (15%)
Antihypertensive drugs	31 (8.4%)
Vasoactive infusion	23 (6.3%)
Dialysis	9 (2.5%)
Platelets	3 (0.8%)
Tracheostomy	2 (0.5%)

[Table/Fig-2]: Interventions in the study population (N=367).

Caesarean section was the most frequent surgical interventions (52.8%) followed by exploratory laparotomy (24.5%) [Table/Fig-3].

The higher number of maternal mortalities in the study could be justified by the fact that patients were referred in very poor condition, majority were transferred from rural area and complexity due to various stated cause of ICU admission. Survival rates were higher in patients with ectopic pregnancy (100%), IIIrd stage complication {uterine inversion (100%), hydatidiform mole (100%)} [Table/Fig-4].

Surgical interventions	n, %
Antepartum haemorrhage	
Uterine artery ligation	5 (9.4%)
Caesarean hysterectomy	1 (1.9%)
Caesarean section	28 (52.8%)
Postpartum haemorrhage	
Medical management	3 (5.7%)
Rupture uterus	
Exploratory laparotomy	13 (24.5%)
Uterine inversion	
Reposition of inversion	1 (1.9%)
Retained placenta	
Manual removal of placenta	2 (3.8%)

[Table/Fig-3]: Surgical interventions in the study population (n=53).
Data are presented as n (%)

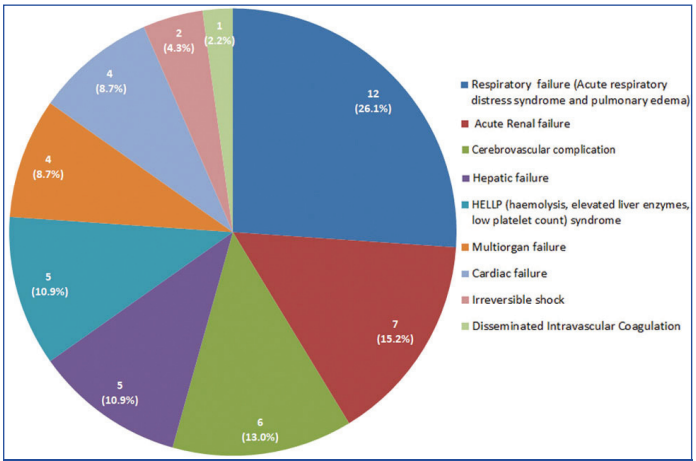
Causes of ICU admission	Total (N, %)	Survivors (n, %)	Non survivors (n, %)
Eclampsia	131	99 (75.6%)	32 (24.4%)
Preeclampsia	50	36 (72%)	14 (28%)
Severe anaemia	36	18 (50%)	18 (50%)
Viral hepatitis	21	10 (47.6%)	11 (52.4%)
Heart disease	22	17 (77.3%)	5 (22.7%)

Placenta previa	16	15 (93.8%)	1 (6.3%)
Abruption placentae	16	12 (75%)	4 (25%)
Ectopic pregnancy	16	16 (100%)	0 (0%)
Rupture uterus	13	11 (84.6%)	2 (15.4%)
Sepsis	15	9 (64.3%)	6 (40%)
Acute renal failure	14	12 (85.7%)	2 (14.3%)
Other medical causes (dengue, cerebralmalaria, seizure disorder)	6	4 (66.7%)	2 (33.3%)
Anaphylactic reaction	2	0 (%)	2 (100%)
IIIrd stage complication			
Postpartum haemorrhage	3	2 (66.7%)	1 (33.3%)
Hydatiform mole	2	2 (100%)	0 (0%)
Uterine inversion	2	2 (100%)	0 (0%)
Retained placenta	2	1 (50%)	1 (50%)

[Table/Fig-4]: Distribution of ICU admission according to outcome of patients.

Following complications occurred in the obstetric patients who admitted to the ICU: respiratory failure (108, 29.4%), cardiac failure (34, 9.3%), irreversible shock (14, 3.8%), hepatic failure (14, 3.8%), other complications (12, 3.3%), septicemia (12, 3.3%), acute renal failure (9, 2.5%), multi organ failure (6, 1.6%), cardiac failure with respiratory complications (6, 1.6%), haemolysis, elevated liver enzymes and low platelets syndrome (6, 1.6%), hepatic with respiratory complications (3, 0.8%), disseminated intravascular coagulation (6, 1.6%), cerebrovascular complication (3, 0.8%), respiratory failure with disseminated intravascular coagulation (1, 0.3%), and secondary postpartum haemorrhage with shock (1, 0.3%).

Hypertensive disorders of pregnancy accounted for the largest number of death (n=46) out of the non survivors (n=101) which represented 45.5% of deaths. Respiratory failure {Acute Respiratory Distress Syndrome (ARDS) and pulmonary oedema)} was the leading complication (26.1%) [Table/Fig-5].



[Table/Fig-5]: Complications in cases of non survivors of eclampsia and preeclampsia contributing to mortality.

The lowest survival was seen in patients with a very short duration of ICU stay, <1 day (p-value <0.00001), and highest survival was seen in patients with a high duration of ICU stay, 3-5 days (p-value <0.00001) [Table/Fig-6]. Similarly, survival in ventilated patients was low in those receiving very short duration of mechanical ventilation, <1 day (p-value=0.009), 1-2 days (p-value=0.036) [Table/Fig-7].

The survival of patients was associated significantly with low SOFA scores with mean SOFA score of 6.48±2.804 among survivors and 10.42±3.579 among non survivors (p-value=0.001) [Table/Fig-8].

SOFA score predicted mortality with an area under ROC (AUROC) of 0.819 (95% CI, 0.654-0.985, p=0.003). The optimum cut-off value was 3.5 score, with sensitivity and specificity of 91.7% and 85.7%, respectively [Table/Fig-9]. Majority of the patients were improved and discharged (n=266, 72.47%).

Duration of stay in ICU	Total (n, %)	Survivor (n, %)	Non survivor (n, %)	p-value (Chi-square test)
<1 day	53	0 (0%)	53 (100%)	<0.00001
1-2 days	58	28 (48.3%)	30 (51.7%)	<0.00001
3-5 days	178	169 (94.9%)	9 (5.1%)	<0.00001
6-10 days	62	55 (80.6%)	7 (19.4%)	0.001
>10 days	16	14 (87.5%)	2 (12.5%)	0.120

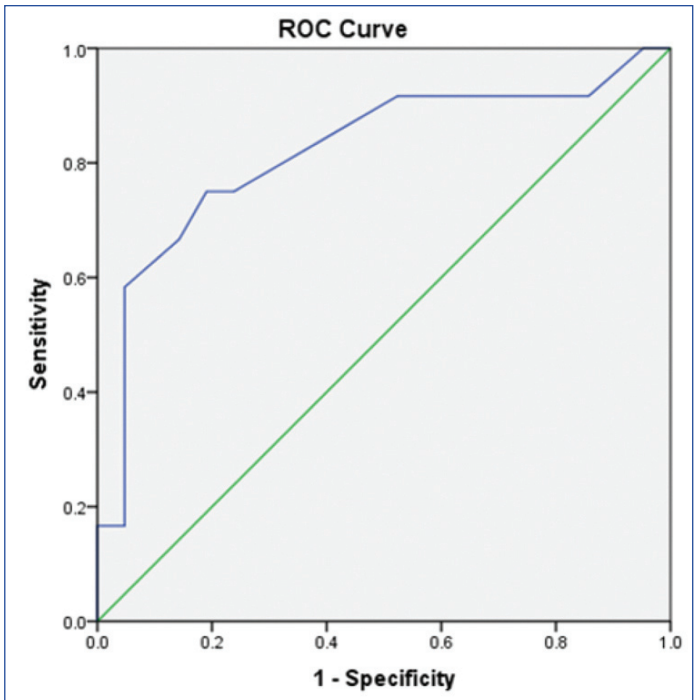
[Table/Fig-6]: Survival against the duration of stay in the ICU.

Duration of mechanical ventilation	Total (n, %)	Survivor (n, %)	Non survivor (n, %)	p-value (Chi-square test)
<1 day	37	7 (18.9%)	30 (81.1%)	0.009
1-2 days	13	1 (7.7%)	12 (92.3%)	0.036
3-4 days	8	2 (25%)	6 (75%)	0.660
>5 days	5	3 (60%)	2 (40%)	0.157

[Table/Fig-7]: Obstetric patients requiring mechanical ventilation admitted in ICU.

Score	Survivors (Mean±SD)	Non survivors (Mean±SD)	p-value (Independent t-test)
Modified SOFA score	6.48±2.804	10.42±3.579	0.001

[Table/Fig-8]: Modified SOFA score in the study population.



[Table/Fig-9]: Receiver operating characteristic (ROC) curve using SOFA score as a predictor of mortality SOFA score predicted mortality with an area under ROC (AUROC) of 0.819 (95% CI, 0.654-0.985, p=0.003). The optimum cut-off value was 3.5 score, with sensitivity and specificity of 91.7% and 85.7%, respectively.

DISCUSSION

The major findings of the present study were that-a) Eclampsia and preeclampsia were the main causes of ICU admission in majority of the obstetric patients; b) Most of the patients admitted in ICU were intervened with transfusion of blood and components, magnesium sulphate therapy and mechanical ventilation; c) Majority of patients admitted in ICU had long duration of stay of 3-5 days, followed by 6-10 days; d) Caesarean section was found to be frequent surgical procedure performed in the obstetric study population; e) Survivors had low SOFA scores as against non survivors who had maximum SOFA scores. Thus, highlighting the importance of SOFA scores in the prediction of mortality in obstetric patients admitted to ICU.

The survival of the patients increased with increasing duration of admission. Furthermore, the survival of patients requiring mechanical ventilation also increased with increasing number of days of ventilation. Both these observations point to the fact that some of the referrals

from surrounding areas are admitted in extremely poor condition to our ICU and do not survive beyond one or two days. The rest of the patient population shows better survival with longer duration of ICU admission and also mechanical ventilation. Decidedly, there is some mortality in the higher end of this population, especially with those patients on mechanical ventilation due to intractable ventilator associated pneumonias, septicemia and multiorgan dysfunction.

Complications present in obstetric patients impose a significant burden to patient's life, emphasising the importance of prompt treatment [22]. In the present study, most common causes office admission in obstetric patients were hypertensive disorders of pregnancy. Similar to the present study, Ceray Y et al., and Shrestha D et al., also found eclampsia (25.5% and 32.5%, respectively) as the most common reason of ICU admission [23,24]. In contrast, other studies found obstetric haemorrhage as the first common reason of ICU admission while hypertensive disorders as the second [4,25,26].

Furthermore, with this study, authors opine that hypertensive disorders of pregnancy contributed to 43.5% of total maternal deaths, which is consistent with morality rates found by Das R and Biswas S, (45.37%) and Sarkar M et al., (45.36%) in the Indian population [27,28]. Tiwari P et al., discovered that hypertensive disorders of pregnancy (42%) were the primary cause of death in the medical college of Jabalpur. This corroborates with our findings as our patients are from Jabalpur [29]. This high number of recorded deaths in the present study is due to a high number of referrals from local community health centres and public health centres in Jabalpur division as well as from a number of surrounding districts.

The major complications leading to death in hypertensive disorders in the present study was respiratory failure (ARDS and pulmonary oedema) (26.1%). Nakimuli A et al. found the abnormal respiration as the leading cause of death in patients with hypertensive disorders in pregnancy [30].

It has been observed that the requisite of meticulous monitoring in patients who received blood transfusion and magnesium sulphate therapy increase the likelihood of ICU admissions [24]. In the present prospective study, majority of the patients received blood transfusion. Similar to the present study, myriad of retrospective studies conducted by Rathod AT and Malini KV (51.4%), Shrestha D et al., (47.5%) and Verma D et al., (42%) also found blood and blood products transfusion as the major frequent intervention in ICU obstetric admissions [4,24,26]. This was followed by mechanical ventilation. Other retrospective studies found packed cell transfusion (50.7%) [25], oxygen supplementation (100%) [31] and mechanical ventilation (85.5%) [32] as the most common intervention in ICU obstetric admissions. In line with Rathod AT and Malini KV, the present study demonstrated caesarean section (34%) as the most common surgical procedure performed in current study population [4]. Numerous studies have reported a high incidence of caesarean section among ICU admissions ranging from 50-70% [32-35].

The current study found that highest survival was seen in patients with a high duration of ICU stay [3-5 days (p-value <0.00001), and 6-10 days (p-value=0.001]. In agreement with Gombar S et al., the present study also found significant association between survivors and non survivors (p-value <0.05) [36]. In terms of duration of ICU stay with poor survival on both ends of the spectrum. There were a high number of deaths in patients with very short stay as they were referred in very poor condition. Also, survival dropped in patients with prolonged stay due to multiple complications leading to a high incidence of multiorgan failure.

The prevalence of maternal mortality has reduced dramatically in the developed countries ranging from 0-27.8% [2,4,23,26,32,37] as compared to developing countries where it ranges from 33.3-40% [2,22]. Low socio-economic level, lack of antenatal care, high prevalence of anaemia, treatment by quacks, and malnutrition in obstetric patients have been attributed to increased rates of maternal mortality in developing countries [26,32]. In the present study, the maternal mortality occurred in 101 (27.52%) patients. Jain S et al., [22] and Bhat PB et al., [3] also found higher maternal mortality rates of 33.3%, 33.8%, and 40%, respectively. However, the low incidence of mortality rates was found in prior studies conducted by Ceray Y et al., (5.2%), Ashraf N et al., (13%), Verma D et al., (19.1%), and Rathod AT and Malini KV (15.5%) [4,23,26,32]. Another interesting finding of the present study was that the majority of the patients survived, which is consistent with the findings of Bhat PB et al., [3].

The present study supports the finding of Oliveira-Neto A et al., who had found that maximum SOFA score was associated with higher mortality. Thus, SOFA scores could be used to stratify the degree of severity of illness in severe maternal morbidity [15].

Limitation(s)

The study period of the present study was limited. It would be desirable to get the ICU data over a larger period to be able to get a more accurate picture of the characteristics of this population.

CONCLUSION(S)

Eclampsia and preeclampsia were the leading cause of ICU admission. Transfusions of blood products and mechanical ventilation followed by haemodialysis were the most important interventions performed. Higher SOFA scores were associated with higher mortality in the ICU obstetric patients. Early identification of the obstetric complications and no delay in patient management can help the obstetrician to reduce the chances of ICU admissions and maternal mortality.

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