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Study of Obstetric Patients Requiring ICU Admission and Fetomaternal Outcome

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ABSTRACT

Background: Pregnancy and postpartum tend to bring several physiological changes in the body of females, which can sometimes cause life-threatening complications. In developing countries, because of the high burden of hypertensive disorders, hemorrhage, and sepsis, obstetric patients requiring intensive care admission are a major public health concern. Early recognition of complications and ICU management plays a critical role in improving fetomaternal outcomes. The current study aimed to study the clinical profile of obstetric patients requiring ICU admission and assess maternal morbidity and mortality, including the associated perinatal outcomes.

Methods:
This prospective observational study was conducted in the Department of Obstetrics and Gynaecology of a tertiary care hospital from November 2022 to September 2024. A total of 93 obstetric patients, including antenatal and postnatal women within 42 days of delivery, who required ICU admission, were enrolled. Data regarding sociodemographic factors, antenatal care, parity, mode of delivery, cause of ICU admission, interventions, and maternal and perinatal outcomes were collected and analyzed.

Results: The overall ICU admission rate in this study was 1.94% most of the cases (41.9%) were aged between 26 and 30 years, and the mean age of the cohort was 27.34 ± 4.8 years. Unbooked cases were common, 60.2% and multigravidas were in 67.7% and primigravidas were in 32.3%. The most frequent cause for admission was due to obstetric causes in 76.3%, followed by blood transfusion in 48.4% and blood product transfusion in 34.4%. The maternal survival rate was 82.8% with mortality in 17.2% of cases. Maternal mortality was significantly associated with higher SOFA scores. The leading causes of maternal mortality were ARDS with respiratory failure (25%) and HELLP with MODS (25%). Perinatal mortality was 16.1%, and 19.4% of neonates required NICU admission.

Conclusion: Hypertensive disorders and obstetric haemorrhage were the leading causes of ICU admissions. Maternal mortality was significantly associated with ventilator requirement and higher SOFA scores. Poor antenatal care and delayed referral contributed to adverse outcomes. Strengthening antenatal services, timely referral, and multidisciplinary ICU care can improve fetomaternal survival.

Keywords: Obstetric ICU, Hypertensive disorders, Maternal mortality, Perinatal outcome, Fetomaternal morbidity.

INTRODUCTION

Usually, Obstetric patients consist of a group of young individuals in the reproductive age group who are classified as healthy. For most of these pregnant women, their pregnancy and labor go without any significant complications [1]. However, there can be unexpected complications that may result in admissions to the Intensive Care Unit (ICU) and raise the rates of death and illness among these patients. Managing these complex pregnancies can be a difficult undertaking that demands the expertise of professionals from many medical disciplines, such as obstetricians, physicians, anesthesiologists, and internists. Although comprising only a small proportion, the death rate among patients admitted to the ICU is substantial [2]. Early detection of the severity of complicating conditions and prompt care in pregnant women may decrease the likelihood of ICU admission and maternal mortality [3]. The unpredictability of serious diseases in obstetric patients complicates therapeutic efforts. The predominant causes of ICU admission for antenatal patients are

hemorrhage, postpartum hemorrhage (PPH), pregnancy-induced hypertension (PIH), sepsis, and anemia [4]. Maternal death or maternal mortality definition as per WHO: The annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy [4]. Obstetric deaths encompass both direct and indirect causes of maternal mortality. Direct obstetric death is attributed to complications that arise during pregnancy, childbirth, and the postpartum period of a pregnant woman. Errors may be attributed to an improper approach and care, as well as a failure to recognize early warning signs and symptoms of the ailment, which ultimately leads to complications. Indirect obstetric deaths do not refer to deaths caused directly by obstetric factors but rather may arise from pre-existing or exacerbated diseases that are acquired during pregnancy [5]. The prevalence of deliveries with complications varies from 0.08 to 0.76% in industrialized nations and from 0.13 to 4.6% in developing nations [6, 7]. The mortality rate among these patients is significant, varying from 0 to 4.9% in industrialized nations [8] and 2-43.63% in underdeveloped countries [8, 9]. Hypertensive disorders and obstetric hemorrhage are the most prevalent risk factors for admission to the intensive care unit [10]. Additional risk factors include sepsis, cardiac disease, and severe anemia [11]. According to UN estimates, approximately 24 million babies were born in India in 2017, and approximately 35,000 mothers passed away during or soon after giving birth, yielding an MMR of 145 per 100,000 live births [5]. This rate accounted for 12% of worldwide maternal fatalities. Considering the magnitude of the problem, aggressive attempts have been made to minimize MMR [5]. Pregnant and postpartum women who require ICU care are a rare, distinctive group, constituting less than 1% of all pregnancies and less than 1% of all ICU admissions [2]. Admission to the obstetric ICU occurs in approximately 0.1-0.9% of deliveries [3]. It ranges from 0.08 to 0.76% in developed countries and 0.13 to 4.6% in developing countries [4]. Depending on the socioeconomic status, criteria for ICU admission, Availability of ICU beds, and high-dependency units, the percentage of ICU admissions varies from country to country. From the Indian perspective, there are relatively few reports, and this study attempts to evaluate the occurrence, indications, course, interventions, and outcomes of obstetric patients admitted to the ICU of a tertiary referral hospital. One step ahead to reduce maternal mortality is timely intensive care; however, the need for ICU admission indicates maternal morbidity. Therefore, this study aimed to analyze the preventable factors, if any, to reduce mortality and morbidity. The current study aimed to evaluate obstetric patients requiring admission to the ICU in terms of the cause for admission, duration of stay, clinical parameters at the time of admission, maternal outcome, and perinatal outcome, and to identify risk factors that influence the maternal outcome.

Material and methods

This cross-sectional observational study was conducted to observe the various obstetric reasons for intensive care unit admission and their outcomes in the Tertiary Care Hospital, Maharashtra, from November 2022 to September 2024. Institutional Ethical approval was obtained for the study after duly following the protocol for Human research based on the Helsinki declaration.

Inclusion criteria

1. All antenatal and postnatal patients within 42 days of delivery requiring ICU admission.
2. Patients admitted with obstetric complications such as Hypertensive disorders of pregnancy (eclampsia, severe preeclampsia, HELLP syndrome).
3. Sepsis or severe infections related to pregnancy and puerperium
4. Patients are willing to provide informed consent

Exclusion criteria

1. Obstetric patients not requiring ICU care
2. Patients are not willing to provide informed consent
3. Complications or cases are referred to other hospitals.

Sample size calculation: Based on the study conducted by Tiwari P et al. [12] the most common cause of ICU admission for the obstetric patients is Eclampsia contributing to 35.7 percent and by taking this value and substituting in the formula: $N = (z_{1-\alpha/2})^2 pq/d^2$ Where Z= standard normal variate at 95 % confidence interval (for a two tailed test, Z=1.96) P= Prevalence of condition studied =35.7% =0.357 q=1-p=1-0.357%= 0.643 d= absolute error = 10%. After solving, the sample size derived was 88.14. Hence, 89 became the sample size for the study. A total of n=93 Obstetric cases were admitted to the ICU during the period of the study; all 93 cases were included in the study.

Methodology: After obtaining permission from the Institutional Ethics Committee, and Obstetric patients who needed to be admitted to the ICU were provided with counseling and informed written consent, the study was conducted. The clinical status, severity, and history of each patient admitted to the intensive care unit were all recorded in the detailed medical history. Several tests, including ultrasound obstetrics, ultrasound of the abdomen and pelvis, 2D echocardiography, and electrocardiography, were performed. In situations of PNC, CXR was also performed. Intermittent MRI and CT scans were performed as needed. Other laboratory tests conducted included Complete Blood Count, anaemia Profile, Liver Function Test, Renal Function Test, Thyroid Function Test, Urine Routine Microscopy and Culture and Sensitivity. Additional investigations tailored to the specific case requirements were conducted. Undertaking the care of an obstetric ICU patient

required collaboration among obstetricians, physicians, and anaesthetists. The patient may need ventilator-assisted breathing, and rigorous monitoring of vital signs was conducted. The Sequential Organ Failure Assessment (SOFA) score was calculated for all the patients at the time of admission, as given in Table 1. Guidelines for Obstetric ICU and HDU. Maternal Health Division, Ministry of Health and Family Welfare, Government of India. 2016 [13].

Table 1: Sequential Organ Failure Assessment SOFA score [14]

Score	*0*	*1*	*2*	*3*	*4*
PaO_2/FiO_2 (mmHg SaO_2/FiO_2	>400	<400 221- 301	< 300 142 - 220	< 200 67 -141	< 100 < 67
Coagulation platelets $10^3/mm^3$	>150	< 150	< 100	< 50	< 20
Liver (bilirubin/mm^3)	< 1.2	1.2 – 1.9	2.0 – 5.9	6.0 – 11.9	>12
Cardiovascular system Hypotension	No hypotension	MAP <70	Dopamine ≤ 5 or dobutamine (any)	Dopamine >5 or norepinephrine ≤ 0.1	Dopamine >15 or norepinephrine ≤ 0.1
CNS Glasgow Coma Scale	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

Statistical analysis: Data were entered into Microsoft Excel and analyzed with Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean, standard deviation, frequency, and percentages, and categorical variables were calculated by the chi-square test. The values of p (<0.05) were considered significant.

Results

The baseline characteristics of the cohort are presented in Table 2. A critical analysis of the table shows that most of the obstetric patients admitted to the ICU were young with the highest frequency of cases in the age range of 26-30 years (41.9%), followed by the age group 21-25 years (32.3%) and 9.7% of cases were older than 35 (9.7%). The mean age (27.34 years) suggests that the aspect of critical obstetric complications mostly takes place during the prime reproductive years. About 60% of the patients were unbooked cases, which is indicative of a lack of access to antenatal care. There was a greater percentage of multigravida (67.7%) than of primigravida (32.3%). Regarding the age of gestation, 53.8% were admitted at term, and the other 46.2% were preterm babies. It is alarming that 60.2% of patients had never received any antenatal checks; this shows that there were gaps in preventative care and early identification of complications. This table highlights the high number of cases with complications that were of poor antenatal surveillance and were the main predisposing factors to ICU admissions.

Table 2: Baseline Demographic and Obstetric Characteristics of ICU Patients (n=93)

Characteristic	*Category*	*N*	*%*
Age (Years)	≤ 20	4	4.3
	21 – 25	30	32.3
	26 – 30	39	41.9
	31 – 35	11	11.8
	> 35	1	9.7
Mean ± SD: 27.34 ± 48			
Booking status	Booked	37	39.8
	Unbooked	56	60.2
Gravida	Primigravida	30	32.3
	Multigravida	63	67.7
Gestational age	Preterm	43	46.2
	Term	50	53.8
Mean ± SD 36.12 ± 2.62 weeks			

ANC visits	None	56	60.2
	1 – 3 visits	8	8.6
	≥ 4 visits	29	31.2

Table 3 shows the prime indications for ICU admission among the cohort. Analysis of the table shows that obstetric conditions (81.7%) were the primary cause of admission. Whereas non-obstetric causes were present in 18.3%. Among obstetric causes, hypertensive disorders, including severe preeclampsia and eclampsia, were found to be common (49.5 %), followed by obstetric hemorrhage (26.9 %). The non-obstetric cases comprised respiratory failure/LRTI (12.9%) and cardiac diseases (9.7%), with a lone case of tuberculosis meningitis. Intrapartum complications occurred frequently, with unconcontrolled hypertension (29%) and excessive bleeding (16.1%) being the most frequent contributors, whereas obstetric hysterectomy was needed in some patients (4.3%). The proportion of postpartum complications that were also significant with hypovolemic shock (29%) cases, uncontrolled hypertension (26.9%) cases, postpartum hemorrhage (14%) cases, and postpartum eclampsia (11.8%) cases. This table shows that one of the most significant causes of ICU admission and peripartum morbidity is hypertensive disorders and hemorrhage.

Table 3: Primary Indications for ICU Admission and Associated Complications

Category	*Indication / Complication*	*N*	*%*
Indication for ICU	Obstetric	76	81.7
	Hypertensive Disorders (Eclampsia, Severe Pre-eclampsia)	46	49.5
	Obstetric Haemorrhage (APH/PPH)	25	26.9
	Non-Obstetric	17	18.3
	Respiratory Failure / LRTI	12	12.9
	Cardiac Diseases	9	9.7
	TB Meningitis	1	1.1
Intra-partum Complications	Uncontrolled Hypertension	27	29.0
	Excess Blood Loss	15	16.1
	Tachycardia	5	5.4
	Obstetric Hysterectomy	4	4.3
Postpartum Complications	Hypovolemic Shock	27	29.0
	Uncontrolled Hypertension	25	26.9
	Postpartum Haemorrhage (PPH)	13	14.0
	Postpartum Eclampsia	11	11.8

Critical care parameters, including interventions and outcomes, have been depicted in Table 4. Analyses done on the SOFA score showed that most patients (67.7%) had low scores (0-6), with a mean SOFA score of 4.39 during admission, and they had significantly improved survival outcomes (p=0.0001). Survival Deceased when their mean scores were higher, and the mean sofa score of non-survivors was 10.88. Interventions were frequent, and in 76.3% of the cases, ventilatory support was required (p=0.03). This shows that respiratory compromise was a major concern in this cohort. Almost half of the patients needed blood transfusions (47.4%), and one-third had blood products (35.4%), which implies significant hemorrhagic complications. In a minority of patients (2.2%), dialysis was required. The majority of patients (95.7%) spent < 7 days in ICU, and prolonged stay was significantly associated with poor outcomes (p=0.001). The overall survival was 82.8% and 17.2% succumbed, and the survival rate was significantly associated with SOFA scores, the use of a ventilator, and the duration of stay at the ICU. This table explains the importance of early interventions and scoring of severity in predicting outcome.

Table 4: Critical Care Parameters, Interventions, and Maternal Outcomes

Parameter	Category	N	%	Association with survival (p-value)
SOFA Score	0-6 (Low)	63	67.7	0.0001*
	6-12 (Moderate)	25	26.9	
	12-18 (High)	5	5.4	

Mean Survivor: 4.39 ± 20.3	Mean non-survivor: 10.88 ± 3.71			
Interventions	Ventilatory Support Required	71	76.3	0.03*
	Blood Transfusion Required	45	48.4	
	Blood Products Required (FFP/Platelets)	32	34.4	
	Dialysis Required	2	2.2	
ICU stay (Days)	≤ 7 days	89	95.7	0.001*
	> 7 days	4	4.3	
Mean ± SD: 3.37 ± 2.04				
Maternal Outcome	Survivors	77	82.8	0.021*
	Non-Survivors	16	17.2	
*Significant				

The causes of maternal mortality are given in Table 5. Analysis of the table showed that the 16 maternal deaths were mostly caused by ARDS, with respiratory failure in 25% of cases; similarly, HELLP syndrome with MOD was also found in 25% of cases. Hypovolemic shock with MODS was the cause in 12.5% of cases, and puerperal sepsis with MODS occurred in 12.5% cases. The other lesser common causes included acute kidney injury, tuberculous meningitis, acute decompensated heart failure, and acute fulminating hepatitis, with MODS occurring in 6.3% cases each. The distribution of causes of mortality shows that multi-organ dysfunction secondary to severe obstetric complications, in particular hypertensive disorders and hemorrhage, were the most frequent contributors. Sepsis and systemic diseases appeared to play a significant role, which shows the need for early detection and multidisciplinary management of high-risk obstetric patients to reduce mortality.

Table 5: Causes of Maternal Mortality (n 16)

Cause of Death	*N*	*%*
ARDS with Respiratory Failure	4	25.0
HELLP Syndrome with Multi-Organ System Dysfunction (MODS)	4	25.0
Hypovolemic Shock with MODS	2	12.5
Puerperal Sepsis with MODS	2	12.5
Acute Kidney Injury (AKI)	1	6.3
Tuberculous Meningitis	1	6.3
Acute Decompensated Heart Failure	1	6.3
Acute Fulminant Hepatitis with MODS	1	6.3
Total	16	100

Perinatal and Neonatal Outcomes are shown in Table 6. Overall, perinatal outcomes were significantly influenced by maternal critical illness. In this cohort, the majority (87.1%) of cases were delivered by cesarean section, which was due to the urgent nature of obstetric complications. The birth weight analysis of the newborns showed a high prevalence of low birth weight, with 25.8% weighing <2.5 kg and 34.4% weighing <1.5 kg, indicating intrauterine compromise and preterm deliveries. Neonatal outcomes in these cases showed that 64.5% of cases were healthy, with 19.4% requiring NICU admission and perinatal mortality of 16.1%. Most of the mortalities were intrauterine deaths in 10.8% of cases and early neonatal deaths in 5.4% of cases. These results point out that maternal morbidity directly impacts neonatal survival and health. High rates of low birth weight, NICU admissions, and perinatal mortality reflect poor fetomaternal outcomes in critically ill obstetric patients.

Table 6: Perinatal and Neonatal Outcomes

Outcome		*N*	*%*
Mode of Delivery	Caesarean Section	81	87.1

	Vaginal Delivery	12	12.9
Birth Weight	Normal (≥ 2.5 kg)	37	39.8
	LCM (< 2.5 kg)	24	25.8
	Very Low (< 1.5 kg)	32	34.4
Neonatal Status	Healthy (No Intervention)	60	645
	Admitted to NICU	18	19.4
	Perinatal Mortality	15	16.1
	Intrauterine Death (IUD)	10	10.8
	Early Neonatal Death (END)	5	5.4

DISCUSSION

The present study was conducted in a Tertiary Care Hospital from November 2022 to September 2024. Among 4784 total deliveries, 93 cases were admitted to the Obstetric ICU to evaluate obstetric patients requiring ICU admission in terms of cause, duration of stay, clinical parameters, maternal outcome, including obstetric and medical complications, maternal death, perinatal outcome, and risk factors influencing maternal outcomes. The ICU admission rate was 1.94%, and the obstetric admission rate was 2.7%. This was comparable to Rathod et al. [15] (1.24%), Bahadur et al. [16] (1.3%), and Barde et al. [17] (4.5%), while higher than Bhat et al. [18] (0.4%) and Shrestha et al. [19] (8.4%). The high admission rate may be attributed to the study setting being a tertiary referral center. Most cases were in the 26–30 years group (41.9%), followed by 21–25 years (32.3%), with a mean age of 27.34 ± 4.8 years. Similar findings were reported by Veerabhadrappa et al. [20] (24.2 ± 0.6), Ashraf et al. [21] (26.3 ± 5.3), and Bhat et al. [18] (28 ± 5.7). This shows that obstetric ICU admissions predominantly occur in the prime reproductive age group. Only 39.8% were booked, and 60.2% unbooked, similar to Shrestha et al. [19] (31.3%, 68.7%). Multigravidas (67.7%) outnumbered primigravidas (32.3%), with pre-eclampsia more common among primi and PPH among multigravidas, similar to Barde et al. [17]. Nearly half (46.2%) were preterm, often iatrogenic due to severe preeclampsia, consistent with Saha et al. [22] (35.2 ± 4.6). Alarmingly, 60.2% had no antenatal visits, underscoring poor maternal health awareness. Most cases (87.1%) underwent caesarean section, reflecting the emergent nature of complications. Intrapartum complications included uncontrolled hypertension (29.1%) and excess blood loss (16.2%), while postpartum complications were hypovolemic shock (29.1%) and uncontrolled hypertension (26.9%). Similar findings were noted by Bahadur et al. [16] and Gupta et al. [23]. Obstetric causes (76.3%) predominated, mainly hypertensive disorders (26.9% severe preeclampsia, 22.6% eclampsia) and haemorrhage (26.9%). Non-obstetric causes included respiratory failure (12.9%) and cardiac disease (9.2%). These findings align with Bahadur et al. [16] (68% obstetric, 32% non-obstetric) and Bhat et al. [18] (61.5% and 38.5%). Most patients had SOFA <6 (67.7%), associated with better survival. Maternal survival was 82.8%, while mortality was 17.2%, comparable to Bahadur et al. [16] (16%) and Saha et al. [22] (16%). Leading causes of death were ARDS with respiratory failure (25%) and HELLP with MODS (25%), followed by puerperal sepsis and hypovolemic shock. Ventilatory support was required in 76.3%, with a significant association with mortality. Blood transfusion was needed in 48.4% and blood products in 34.4%. Dialysis was rarely required (2.2%). Mean ICU stay was 3.37 ± 2.04 days, comparable to Farzi et al. [24] (2.8 ± 1.6). Cesarean delivery was common (87.1%). Very low birth weight was noted in 34.4%, and perinatal mortality was 16.1%, consistent with Bahadur et al. [16] (24%). NICU admission occurred in 19.4%. The study highlights that the SOFA score is a reliable prognostic tool, but the small sample size and single-center design limit generalizability. Future research should evaluate obstetric-specific SOFA modifications for better prediction of outcomes.

CONCLUSION

The present study concluded that training in emergency obstetrics is essential for the immediate management of complications. Junior doctors at peripheral health clinics require training to detect at-risk patients and facilitate prompt referrals. Public awareness of the significance of sufficient antenatal care, recognition of warning signs associated with obstetric problems, and the necessity of promptly contacting medical facilities in emergencies must be established. Advanced maternal age, multiparity, and elevated SOFA scores upon ICU admission were strongly correlated with maternal mortality. Early identification and timely referral to a tertiary center equipped with intensive care capabilities should be advocated within the medical community to reduce the rates of ICU admissions, maternal death, and morbidity.

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