

## A Retrospective analysis of the factors influencing Outcomes in Critically ill Obstetric Patients admitted in ICU

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### ABSTRACT

**Introduction:** An indicator of pronounced maternal morbidity is intensive care unit (ICU) admissions of obstetric patients. Few studies have been published concerning ICU admissions of obstetric patients in the developing world, Based on the fact that the risk factors defining pronounced maternal morbidity and maternal mortality in the developing world are not fully established, the present retrospective study was conducted to analysed & evaluate the obstetric admissions to the ICU in an attempt to identify the risk factors influencing maternal outcome.

**Methods:** This Retrospective Analytical study involved 100 randomly selected Obstetrical patients admitted to ICUs . Prior Consent was obtained from Local Randomly selected Tertiary care hospitals to see the records of the patients from MRD . The medical records for these patients were reviewed for the collection and classification of data including the patient characteristics, the obstetric history, the preexisting medical disorders and the causes that necessitated admission to the ICU.

**Results:** Major obstetric and medical conditions requiring ICU admission were Haemorrhage , Hypertensive Disorders of Pregnancy (Preeclampsia , Eclampsia , PIH ) Severe Anemia & Sepsis. The number of maternal deaths was 13 % of obstetric patients admitted in ICU in our study . The commonest causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome. The observed mean SAPS II scores between the surviving group of patients and the nonsurviving group of patients was statistically significant.

**Conclusion:** There is a need for HDU in tertiary care hospitals. Obstetric hemorrhage and hypertensive disorders of pregnancy are the major risk factors for ICU admission. Majority of complications occurred in women with gestational age of 37–42 weeks. There is a need to train obstetricians in obstetric medicine and critical care to do justice to these critically ill pregnant women. Focus of care for the obstetric patients who bear the major risk factors and who are admitted to the ICU should be carried out under the guidance of the ICU scoring systems such as the SAPS II & others like APACHE-II, SOFA scores.

**Key words:** Retrospective analysis–Intensive care–Obstetrical care–SAPS II

### 1 INTRODUCTION

Despite the drastic decrease in maternal morbidity over the last few decades because of improvements in obstetric care, maternal mortality remains to be a challenge in the de-

veloping world. Patients receiving obstetric care are young and healthy in general, there is an indisputable potential for catastrophic complications related to the pregnancy and the delivery. Maternal critical care reflects interdisciplinary care in any hospital area according to the severity of illness of the pregnant woman It reflects the quality of women's health care of a nation.<sup>1,2</sup> Physiological changes of preg-

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nancy along with pregnancy specific diseases may lead to rapid deterioration of the health status of the parturient warranting ICU care. An indicator of pronounced maternal morbidity is intensive care unit (ICU) admissions of obstetric patients. An ICU receives obstetric patients with a variety of medical and surgical emergencies and provides supportive care for patients who suffer obstetric complications. These patients needing intensive care present an exclusive challenge for the intensivist.

An indicator of pronounced maternal morbidity is intensive care unit (ICU) admissions of obstetric patients. Only a few studies have been published concerning ICU admissions of obstetric patients in the developing world, in which maternal mortality rates have ranged from 28% to 60%<sup>1,2</sup>, as compared to the rates ranging from 3% to 20% in studies concerning ICU admissions of obstetric patients in the developed world<sup>3</sup>. Measurement of obstetric critical care is a challenge. The pattern of admission varies widely among countries with different standards of obstetric / ICU care. In developing countries such as India, due to scarcity of ICU resources, maternal morbidity and mortality for such patients is on the higher side.<sup>4</sup> Indian healthcare with limited availability of well-equipped critical care units and ICU bed strength typically <10% of total hospital beds in majority of advanced centers, it becomes difficult to obtain an ICU bed for many of the deserving critically ill patients.<sup>5</sup>

The majority of such deaths can be prevented if these complications are managed with timely and effective obstetric critical care. There is a wide gap in the admission and mortality rate of obstetric patients admitted to the critical care units between developed and developing countries despite their similar clinical profile.

Based on the fact that the risk factors defining pronounced maternal morbidity and maternal mortality in the developing world are not fully established, the present retrospective study was conducted among local Randomly selected Tertiary Health care Centres to analysed & evaluate the obstetric admissions to the ICU in the setting of a tertiary referral hospital in an attempt to identify the risk factors influencing maternal outcome.

## 2 METHEDODOLOGY

This Retrospective Analytical study involved Prior Consent from Hospital Authorities / Medical Superintendents of the Local Randomly selected Tertiary care hospitals to see the records of the patients from Medical Records Department (MRD). The study was conducted within ethical standards. The Obstetrical Patients who were admitted in the ICUs of randomly selected tertiary care hospitals including Our Teaching Hospital in the city were selected for the study. Randomization was done using computer tables in selecting data. The hospitals selected were equipped with an emergency department and ICU of appropriate beds serving adults and neonates, attending emergency physicians and residents, attending anesthesiologists who specialized in intensive care medicine. It was observed in the records

that the obstetric patients who seek care for delivery at the medical centers were admitted to the obstetrics department for delivery after initial evaluation at the emergency department. All Patients underwent standard clinical examinations, routine biochemical and haematological investigations, Ultrasonography of whole abdomen and received treatment as decided by their treating physician and surgeon. Medical record numbers were used to generate the data for analysis. After delivery, those patients who required intensive care because of a postpartum cause complicating the delivery were admitted to the ICUs, where the intensive care medicine / Intensivist / Anesthesiologist assume the primary responsibility along with attending obstetricians.

For the purpose of the present study, 100 of the randomly selected obstetric patients ( candidates / study subjects ) who sought care for delivery at the emergency department and who were admitted to the ICU between January 2018 to July 2019 were retrospectively identified. The medical records for these patients were reviewed for the collection and classification of data including the patient characteristics, the obstetric history, the preexisting medical disorders and the causes that necessitated admission to the ICU. The data collected included the demographics, obstetric, and medical history, including admitting diagnosis, gestation age, gravida status, the mode of delivery, any obstetric complication, and outcome of baby delivered. The ICU-related data included the critical illness severity scores, organ failures, any sepsis, treatment given during ICU admission, including mechanical ventilation, inotropic support, and the ICU stay. The patients were followed up to 28 days in obstetric outpatient department. The hospital stay and the final outcome of the patient were noted.

The causes that necessitated admission to the ICU were identified as preeclampsia, eclampsia, hemorrhage, sepsis, and respiratory failure. Preeclampsia required the presence of hypertension (defined as blood pressure More than 140/90 mm Hg, systolic blood pressure +30 mm Hg, diastolic blood pressure +15 mm Hg) and proteinuria ( More than 0.3 g per 24 hours). Severe preeclampsia required the presence of severe hypertension (defined as blood pressure More than 160/110 mm Hg), severe proteinuria ( More than 2.0 g per 24 hours), oliguria (defined as urine output less than 60 mL per 2 successive hours or less than 500 mL per 24 hours), epigastric pain, liver pain, headache, blurred vision, or pulmonary edema. Eclampsia required the presence of any seizure during pregnancy. Severe hemorrhage was defined as blood loss  $\geq 1.5$  mL at once; blood loss  $\geq 2500$  mL in 24 hours; blood loss requiring  $\geq 2500$  mL of packed cells; blood loss requiring plasma expanders; or blood loss resulting in death and was required to occur during the pregnancy, at the time of the pregnancy outcome, or immediately after the time of the pregnancy outcome (vaginal birth or cesarean delivery). Sepsis was defined as the systemic inflammatory response to an infection in the presence of a body temperature more than 38°C or less than 36°C, a heart rate More than 90/min, a respiratory rate more than 20/min, a PaCO<sub>2</sub> less than 32 mm Hg, a white blood cell count more than 12 000/mm<sup>3</sup> or less than 4000/mm<sup>3</sup>,

or more than 10% immature leukocytes. HELLP (hemolytic anemia, elevated liver enzymes, and low platelet count) syndrome, when present, was separately recorded. The diagnosis of HELLP syndrome required the presence of hemolysis (bilirubin level  $\geq 1.0$  mg/dL or  $17.1 \mu\text{mol/L}$ ), hepatic cytolysis (alanin aminotransferase level  $\geq 70$  U/L), and thrombocytopenia (platelet count less than  $100\,000/\text{mm}^3$ ).

The duration of the ICU stay and the specific interventions that had been undertaken at the ICU (such as the use of intubation, mechanical ventilation, tracheostomy, and intensive monitoring; the use antihypertensive therapy; the use of hemodiafiltration, dialysis, and plasmapheresis, the use of fresh frozen plasma, packed erythrocytes, and platelets; and the use of vasoactive infusions [such as norepinephrine, epinephrine, and dopamine], the use of fibrinogen infusions; and the use of antibiotics) were recorded. Renal replacement therapy was defined as any form of hemodialysis or hemofiltration alone or in combination. The daily fluid balance was calculated as the total fluid balance during the ICU stay divided by the duration of the ICU stay in days. The complications that were encountered at the ICU, such as disseminated intravascular coagulation (DIC) and multiorgan failure, were recorded. The diagnosis of DIC required a low platelet count (less than  $100 \times 10^9/\text{L}$ ), a low fibrinogen level (less than  $3 \text{ mg/L}$ ), a prolonged prothrombin time (more than 14 seconds), a high international normalized ratio level (more than 1.3), and a prolonged partial thromboplastin time (more than 40 seconds). Multiorgan failure was defined as the failure of 3 or more critical physiological systems, including the respiratory system, the cardiovascular system, the nervous system, the hepatobiliary system, or the urinary system.

Using the relevant clinical data and the laboratory data, the Simplified Acute Physiology Score (SAPS II) was calculated for each patient. Using the SAPS II score, (The point score is calculated from 12 routine physiological measurements during the first 24 hours, information about previous health status and some information obtained at admission) the maternal mortality rate was estimated for each patient.

Continuous data were expressed as mean  $\pm$  standard deviation (SD). The data were analyzed by IBM SPSS Statistics 23. The mean SAPS II scores and the mean estimated maternal mortality rates for the surviving patients and the nonsurviving patients were compared using the Mann-Whitney U test. Overall,  $p < 0.05$  was proposed to represent statistical significance after correction.

### 3 RESULTS

In the present study, the obstetrical variables and various demographic details of the patients are displayed in Table 1

80 % of the cases in ICU were referred from outside hospitals. 53 % of the cases were in the age group of 20–25 years, followed by 21 % of the patients in age group 26–30 years. 42 % of women were in their first pregnancy followed by 35 % of women who were in their second pregnancy.

**Table 1. Obstetrical Histories & Demographics**

S.No	Obstratrical Variables	Demographic detail
1	Maternal age	20 – 38 years ( Mean $29.4 \pm 2.5$ years)
2	Gestational Age	12 – 40 weeks
3	Parity	Primipara – 39 % Multiparous – 61%
4	Cases of Multiple Pregnancy	1 % ( Twin )
5	Mode of Delivery	34% Vaginal 66% Caesarean

Gestational age on admission to the hospitals was calculated predominantly based on the date of last menstrual period. Majority of the women were of 34–39 weeks of gestation.

Maximum cases at the time of ICU Admission were Postpartum followed by antepartum & abortion . ( Table 2)

**Table 2. Type & time of ICU Admission**

S.No.	Type & time of ICU Admission	Percentage (n=100)
1	Postpartum	76%
2	Antepartum	16%
3	Ectopic Pregnancy	01%
4	Abortion	07%

The postpartum causes that necessitated admission to the ICU and the preexisting medical disorders are shown in Table 3

**Table 3. ICU and the preexisting medical disorders**

S.No	Major obstetric and medical conditions requiring ICU admission	Percentage ( n=100)
1	Haemorrhage	53 %
2	Hypertensive Disorders of Pregnancy (Preeclampsia , Eclampsia , PIH )	26%
3	Severe Anemia	11%
4	Sepsis	6%
5.	Uncontrolled Diabetes	2%
6.	COPD / Asthma	1%
7	Heart Conditions ( RHD / Mitral stenosis / CAD etc)	1%

The common therapy which was given in the ICU is shown in Tabl 4 , was the blood (54 %) and blood component (23 %) transfusion, followed by ionotropic support (35 %), and followed by ventilator support (40%)

Surgical Procedures were also performed. The commonest surgical procedure performed was the cesarean section followed by peripartum hysterectomy, Laparotomy & Repair of the ruptured uterus.

The number of maternal deaths was 13 % of obstetric patients admitted in ICU in our study . The commonest causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome (Table -5)

**Table 4. Therapy in ICU**

S.No	Therapy in ICU	Percentage (n=100)
1.	Ventilatory support	40%
2.	Blood Transfusion	54%
3.	Blood Component Transfusion	23%
4.	Inotropic support ( Adrenaline , Dopamine, Dobutamine , Noradrenaline etc)	35%
5.	Dialysis	14%

**Table 5. Causes for maternal mortality**

S.No	Causes of Maternal Mortality	Numbers / Percentage (n=13)
1.	Hemorrhagic Shock	7 ( 53.84%)
2.	Multiorgan system Failure ( Due to HELLP / Sepsis / DIC )	3 (23%)
3.	Acute Pulmonary Edema	1 (7.69%)
4.	Congestive Cardiac Failure	1 (7.69%)
5.	Renal Failure / Uremia	1 (7.69%)

For the entire group of patients, the SAPS II scores ( The point score is calculated from 12 routine physiological measurements during the first 24 hours, information about previous health status and some information obtained at admission ) ranged from 20 to 88 (mean, 39 ± 2) . For the surviving group of patients, the SAPS II scores ranged from 20 to 88 (mean, 35 ± 2) and for the nonsurviving group of patients, the SAPS II scores ranged from 43 to 71 (mean, 61 ± 3) . The difference between the surviving group of patients and the nonsurviving group of patients was statistically significant regarding both the mean SAPS II scores (P < 0 .001)

#### 4 DISCUSSION

Although the pregnancy and the delivery are physiological processes, any sort of morbidity that might be encountered during these time courses might lead to mortal consequences regarding not only the fetus but the mother as well. Therefore, postpartum morbidity has become the principle issue in an attempt to evaluate the quality of maternity care. Hence, the need to continually strive to institute measures for the early identification and management of morbidity regarding maternity care is underscored. Despite the advances in the standard of care in the ICUs in the recent years, maternal mortality remains to be a challenge. Obstetric medicine is unique and complicated. Obstetric medicine is different from the general medicine because of the various physiological changes occurring in pregnancy, and only an experienced obstetrician who has good knowledge of obstetric medicine can interpret and understand complex conditions in pregnancy. The threshold of an insult required for ICU admission is low in obstetric patients compared to non-pregnant population. We have seen women developing disseminated intravascular coagulation very rapidly with ob-

stetric complications like hemorrhage and hypertensive disorders. The threshold for ventilator support also is low in pregnancy. These are just observations and experiences, and further study is needed to validate the same.

The commonest gestational age was term gestation indicating that complications are common at term ( Table - 1) and around the time of delivery followed by women in gestational age group of 30–34 weeks and 35–36 weeks, explaining the high-risk cases requiring early termination. The mean gestational age reported in other studies ranges from 31 to 36 weeks <sup>6,7,8</sup>. 76 % of women were admitted to our hospital in puerperium. These were the referred cases which delivered in outside hospitals. This can be used as an indicator of care in peripheral hospitals especially the management of third stage of labor. Hence, there is a need for education in peripheral hospitals for the nurses and junior doctors to identify at-risk cases and for timely referral.

*Postpartum admissions* accounted for 76% (Table -2). The reasons can be postpartum complications , more especially postpartum hemorrhage, patients requiring cesarean section were shifted to the ICU after cesarean, some patients with risk factors were already in active labor and were shifted to the ICU after delivery, cases were referred from outside after delivery, and some patients developed complications during cesarean section. In majority of cases Post-operative admissions were not out of complications related to surgical skills but because of the antenatal morbidity for which cesarean was done. For example, conditions like placental abruption, obstructed labor, HELLP syndrome, severe preeclampsia, and eclampsia that require operative delivery, as such, are more prone for postpartum hemorrhage and disseminated intravascular coagulation. The severe preeclampsia patients are more prone for pulmonary edema after cesarean section. Operative delivery in the presence of medical or obstetric complication can be a potential risk factor for ICU admission.

Obstetric hemorrhage was the commonest condition requiring ICU admission (Table 3 ) followed by hypertensive disorder of pregnancy . The other major conditions were severe anemia , heart disease , and sepsis . Some studies report hypertensive disorders as the commonest condition<sup>9,10</sup>. Some studies report obstetric hemorrhage as the commonest condition<sup>11,12</sup>. For hypertensive disorders, the range is 7–73.6 % from some studies <sup>6-.....</sup>, and the mean is 34.85 %. For obstetric hemorrhage, the range is 11–62.5 %, and the mean is 27.90 % from different studies.<sup>6-.....</sup>

Sepsis was seen in the range of 2.4–18.3 % in other studies<sup>7,13</sup>. Some studies reported sepsis rates similar to our study<sup>12,14</sup>.

One study done in India reports a high rate of anemia (38.18 %) and also as the commonest risk factor.<sup>15</sup>

The commonest surgical procedure performed was the emergency cesarean section . Other studies report a high percentage of cesarean sections among ICU patients, 78.5 %<sup>7</sup>, 50.7 %<sup>10</sup> ,& 52.9 % <sup>11</sup>, compared to this study. This indicates that most of the women needed operative delivery. Cesarean delivery, especially in the presence of obstetric and medical comorbidities, can be a potential risk factor

for ICU admission and needs further research. According to Zwart, cesarean delivery is an adjusted risk factor for ICU admission<sup>11</sup>

The number of maternal deaths was 13% . The commonest causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome . Mortality in this study is high compared to other studies<sup>6,7,10,11,12</sup> but low compared to studies done in India<sup>8,13</sup> . Multiorgan dysfunction has been reported as the commonest cause of mortality in some studies.<sup>7</sup> Irrespective of the primary disease, multiorgan failure commonly occurs in pregnancy as an end result . The causes for multiorgan failure in this study were mainly HELLP syndrome & sepsis.

## 5 CONCLUSION

There is a need for HDU in tertiary care hospitals. Obstetric hemorrhage and hypertensive disorders of pregnancy are the major risk factors for ICU admission. Majority of complications occurred in women with gestational age of 37–42 weeks. There is a need to train obstetricians in obstetric medicine and critical care to do justice to these critically ill pregnant women. Commonest cause for maternal mortality was hemorrhagic shock and multiorgan dysfunction. There is a need for training in emergency obstetrics so that the complication can be managed right at the time of occurrence. Training is also required for the junior doctors working in peripheral health centers in identifying at-risk cases and for timely referral. Severe anemia, cardiac disease, sepsis, need for a cesarean delivery, and more than one diagnosis on admission are the other risk factors for ICU admission.

Considering that the use of the SAPS II scores has enabled the reliable estimation of the mortality rates in the present study, the attempts at defining the focus of care for the obstetric patients who bear the major risk factors and who are admitted to the ICU should be carried out under the guidance of the ICU scoring systems such as the SAPS II & others like APACHE-II, SOFA scores.

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Compliance With Ethical Standards.

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