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An Epidemiological Study of the Major Factors Influencing Outcomes in Critically Ill Obstetric Patients

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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 analyze and evaluate the obstetric admissions to the ICU in an attempt to identify the risk factors influencing maternal outcome. **Methods:** This retrospective analytical study involved 200 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 Medical Records Department. 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 hemorrhage, hypertensive disorders of pregnancy (preeclampsia, eclampsia, and pregnancy-induced hypertension), severe anemia, and sepsis. The number of maternal deaths was 13% of obstetric patients admitted in ICU in our study. The most common causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome. The observed mean Simplified Acute Physiology Score (SAPS II) between the surviving group of patients and the non-surviving group of patients was statistically significant. **Conclusion:** There is a need for high-dependency unit 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 and others such as APACHE-II and SOFA scores.

Keyword: Retrospective analysis, Intensive care, Obstetrical care, Simplified Acute Physiology Score II

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Introduction

Despite the drastic decrease in maternal morbidity over the past few decades because of improvements in obstetric care, maternal mortality remains to be a challenge in the developing 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.[1,2] Physiological changes of pregnancy along with pregnancy-specific diseases may lead to rapid deterioration of the health status of the parturient warranting intensive care unit (ICU) care. An indicator of pronounced maternal morbidity is 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 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%,[1,2] as compared to the rates ranging from 3% to 20% in studies concerning ICU admissions of obstetric patients in the developed world.[3] 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 are on the higher side.[4] Indian health care 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.[5]

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

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world are not fully established, the present retrospective study was conducted among local randomly selected tertiary health care centers to analyze and 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.

Methodology

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. 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, and 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 hematological 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 assumes the primary responsibility along with attending obstetricians.

For the purpose of the present study, 200 of the randomly selected obstetric patients (candidates/study subjects) who seek care for delivery at the emergency department and who were admitted to the ICU between October 2019 and March 2020 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 was as preeclampsia, eclampsia, hemorrhage, sepsis, and respiratory failure. Preeclampsia required the presence of hypertension (defined as blood pressure more than 140/90 mmHg, systolic blood pressure +30 mmHg, and diastolic blood pressure +15 mmHg), and proteinuria (more than 0.3 g/24 h). Severe preeclampsia required the presence of severe hypertension (defined as blood pressure more than 160/110 mmHg), severe proteinuria (more than 2.0 g/24 h), oliguria (defined as urine output <60 mL/2 successive hours or <500 mL/24 h), 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 ≥1.5 mL at once; blood loss ≥2500 mL in 24 h; blood loss requiring ≥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 $PaCO_2$ <32 mmHg, a white blood cell count more than 12,000/mm^3 or <4000/mm^3, or more than 10% immature leukocytes. Hemolytic anemia, elevated liver enzymes, and low platelet count (HELLP) syndrome, when present, were separately recorded. The diagnosis of HELLP syndrome required the presence of hemolysis (bilirubin level ≥1.0 mg/ dL or 17.1 μmol/L), hepatic cytolysis (alanine aminotransferase level ≥70 U/L), and thrombocytopenia (platelet count <100,000/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 (<100 ×10^9/L), a low fibrinogen level (<3 mg/L), a prolonged prothrombin time (more than 14 s), a high international normalized ratio level (more than 1.3), and a prolonged partial thromboplastin time (more than 40 s). Multiorgan failure was defined as the failure of three 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 SAPS II was calculated for each patient. Using the SAPS II (the point score is calculated from 12 routine physiological measurements during the first 24 h, 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 ± standard deviation. The data were analyzed by IBM SPSS Statistics 23. The mean SAPS II and the mean estimated maternal mortality rates for the surviving patients and the non-surviving patients were compared using the Mann–Whitney U-test. Overall, $P < 0.05$ was proposed to represent statistical significance after correction.

Results

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

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

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 and abortion [Table 2].

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

The common therapy which was given in the ICU is shown in Table 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 most common surgical procedure performed was the cesarean section followed by peripartum hysterectomy, laparotomy, and Repair of the ruptured uterus.

The number of maternal deaths was 13% of obstetric patients admitted in ICU in our study. The most common causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome [Table 5].

Table 1: Obstetrical histories and demographics

S. No.	*Obstetrical variables*	*Demographic detail*
1	Maternal age	21–39 years (mean 28.7±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% cesarean

Table 2: Type and time of ICU admission

S. No.	*Type and time of ICU admission*	*Percentage (n=200)*
1	Postpartum	76
2	Antepartum	16
3	Ectopic pregnancy	1
4	Abortion	7

Table 3: Frequency of Postpartum causes & other Pre existing Medical disorders that required admission to the ICU

S. No.	*Major obstetric and medical conditions requiring ICU admission*	*Percentage (n=200)*
1	Hemorrhage	53
2	Hypertensive disorders of pregnancy (preeclampsia, eclampsia, and 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

ICU: Intensive care unit, PIH: Pregnancy-induced hypertension, RHD: Rheumatic heart disease, CAD: Coronary artery disease

Table 4: Therapy in ICU

S. No.	*Therapy in ICU*	*Percentage (n=200)*
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

ICU: Intensive care unit

For the entire group of patients, the SAPS II (the point score is calculated from 12 routine physiological measurements during the first 24 h, 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 ranged from 20 to 88 (mean, 35 ± 2) and for the non-surviving group of patients, the SAPS II ranged from 43 to 71 (mean, 61 ± 3). The difference between the surviving group of patients and the non-surviving group of patients was statistically significant regarding both the mean SAPS II ($P < 0.001$).

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 also 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 DIC very rapidly with obstetric complications such as 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 most common 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.[6-8] About 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

Table 5: Causes for maternal mortality

S. No.	*Causes of maternal mortality*	*Numbers/percentage (n=26)*
1.	Hemorrhagic shock	14 (53.84)
2.	Multiorgan system failure (due to HELLP/sepsis/DIC)	6 (23)
3.	Acute pulmonary edema	2 (7.69)
4.	Congestive cardiac failure	2 (7.69)
5.	Renal failure/uremia	2 (7.69)

DIC: Disseminated intravascular coagulation, HELLP: Hemolysis, elevated liver enzymes, and low platelet count

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 such as placental abruption, obstructed labor, HELLP syndrome, severe preeclampsia, and eclampsia that require operative delivery, as such, are more prone for postpartum hemorrhage and DIC. The severe preeclampsia patients are more prone to 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 most common 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 most common condition.[9,10] Some studies report obstetric hemorrhage as the most common condition.[11,12] For hypertensive disorders, the range is 7–73.6% from some studies,[6] and the mean is 34.85%. For obstetric hemorrhage, the range is 11–62.5%, and the mean is 27.90% from different studies.[6]

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

One study done in India reports a high rate of anemia (38.18%) and also as the most common risk factor.[13]

The most common surgical procedure performed was the emergency cesarean section. Other studies report a high percentage of cesarean sections among ICU patients, 78.5%,[7] 50.7%,[10] and 52.9%,[11] 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.[11]

The number of maternal deaths was 13%. The most common causes of maternal mortality were hemorrhagic shock and multiorgan dysfunction syndrome. Mortality in this study is high compared to other studies[6,7,10-12] but low compared to studies done in India.[8,13] Multiorgan dysfunction has been reported as the most common cause of mortality in some studies.[7] 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 and sepsis.

Conclusion

There is a need to focus more for high-dependency unit 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. The most common 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 1 diagnosis on admission are the other risk factors for ICU admission.

Considering that the use of the SAPS II 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 and others such as APACHE-II and SOFA scores.

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References

1. Karnad DR, Lapsia V, Krishnan A, Salvi VS. Prognostic factors in obstetric patients admitted to an Indian intensive care unit. Crit Care Med 2004;32:1294-9.
2. Maine D, Chavkin W. Maternal mortality: Global similarities and differences. J Am Med Womens Assoc 2002;57:127-30.
3. Nagaya K, Fetters MD, Ishikawa M, Kubo T, Koyanagi T, Saito Y, *et al*. Causes of maternal mortality in Japan. JAMA 2000;283:2661-7.
4. Sriram S, Robertson MS. Critically ill obstetric patients in Australia: A retrospective audit of 8 years' experience in a tertiary intensive care unit. Crit Care Resusc 2008;10:124.
5. Tempe A, Wadhwa L, Gupta S, Bansal S, Satyanarayana L. Prediction of mortality and morbidity by simplified acute physiology score II in obstetric intensive care unit admissions. Indian J Med Sci 2007;61:179-85.
6. Rios FG, Risso-Vazquez A, Alvarez J, Vinzio M, Falbo P, Rondinelli N, *et al*. Clinical characteristics and outcomes of obstetric patients admitted to the intensive care unit. Int J Gynecol Obstet 2012;119:136-40.
7. Neto AF, Parpinelli MA, Cecatti JG. Factors associated with maternal death in women admitted to an intensive care unit with severe maternal morbidity. Int J Gynaecol Obstet 2009;105:252-6.
8. Gupta S, Naithani U, Doshi V, Bhargava V, Vijay BS. Obstetric critical care: A prospective analysis of clinical characteristics, predictability, and fetomaternal outcome in a new dedicated obstetric intensive care unit. Indian J Anesth 2011;55:146-53.
9. Zeeman GG, Wendel GD, Cunningham FG. A blueprint for obstetric critical care. Am J Obstet Gynecol 2003;188:532-6.
10. Keizer JL, Zwart JJ, Meerman RH, Harinck BI, Feuth HD, van Roosmalen J, *et al*. Obstetric intensive care admissions: A 12-year review in a tertiary care centre. Eur J Obstet Gynecol Reprod Biol 2006;128:152-6.
11. Zwart JJ, Dupuis JR, Richters A, Ory F, van Roosmalen J. Obstetric intensive care unit admission: A 2-year nationwide population-based cohort study. Intensive Care Med 2010;36:256-63.
12. Baskett TF, O'Connell CM. Maternal critical care in obstetrics. J Obstet Gynaecol Can 2009;31:218-21.
13. Yuel VI, Kaur V, Kaur G. Critical care in obstetrics-scenario in a developing country. J Obstet Gynaecol India 2008;58:217-20.
14. Wanderer JP, Leffert LR, Mhyre JM, Kuklina EV, Callaghan WM, Bateman BT. Epidemiology of obstetric-related ICU admissions in Maryland: 1999-2008. Crit Care Med 2013;41:1844-52.