



Critical Care in Obstetrics—Where Do We Stand? A 5-Year Experience in a Tertiary Care Referral Center in India

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Abstract

Sudden and unexpected complication during pregnancy and childbirth is not uncommon, making intensive care unit (ICU) admission necessary. The aims and objectives of this study are to analyze the spectrum of obstetric ICU admissions and study their outcome in terms of morbidity and mortality and to suggest ways to improve critical obstetric care. The present study was a retrospective descriptive study undertaken in Kalinga Institute of Medical Science and Pradyumna Bal Memorial Hospital, Bhubaneswar, Odisha. Medical records of 53 critically ill obstetric patients admitted to the ICU from January 2010 to December 2015 were analyzed to evaluate their spectrum and outcome. Out of 4681 deliveries, 53 (1.19%) were admitted to the ICU. Mean age of the study group was 28.25 years with more of antenatal than the postnatal admissions (83.01% vs. 16.98%). Majority (83.01%) were admitted in the ICU due to obstetric cause. Hypertensive disorders of pregnancy were the leading cause ($n = 24$) where preeclampsia dominates the most. The second most common cause was obstetric hemorrhage (30.18%). Of the non-obstetric causes, majority had cardiac (13%) followed by pulmonary cause (9%). The mean duration of ICU stay was 2.19 ± 1.58 days and hospital stay was 11.11 ± 13.44 days. Transfusion of blood/components was the commonest intervention (43.39%) followed by magnesium sulfate administration (32.07%) and mechanical ventilation (13.20%). There was one mortality due to septic abortion with multiorgan failure. Apart from obstetricians and intensivists, various multidisciplinary specialists were involved in the patient management. Outcome of critically ill obstetric patients is greatly influenced by early admission, proper and timely management, and multidisciplinary input in the ICU. A dedicated obstetric ICU could be an ideal setting to handle these cases.

Keywords Critical care · Intensive care unit · Maternal mortality · Maternal morbidity · Obstetric ICU admission

Introduction

Sudden catastrophe complicating fetomaternal health is not uncommonly encountered during pregnancy and childbirth which may lead to increase morbidity and mortality despite the current progress in medical science and maternity care. [1]

As per the United Nations (UN) agencies, every year around 117,000 maternal deaths occur in India which constitutes almost one quarter of the maternal deaths worldwide

annually. More women die due to pregnancy-related causes in India than anywhere else in the world [2].

To reduce such mortality, strengthening of critical care management of high-risk mothers takes the top priority. Although critical care for obstetric patients is gradually evolving, there are no specific guidelines. In most of the hospitals, they are admitted to medical, surgical intensive care unit (ICU) or obstetric high-dependence units (HDUs). Very few hospitals have a dedicated obstetric intensive care unit. Though small in number, obstetric ICU admissions can be considered a special category as they are more challenging due to presence of a fetus, an altered maternal physiology, unpredictability of the complications, and high mortality [2, 3]. The WHO states that, “there is a story behind every maternal death or life-threatening complication” [4] so a better knowledge and understanding of the spectrum of this category of patients is the first step towards reduction of both maternal morbidity and mortality [5]. Early intervention and

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multidisciplinary input in the ICU can alleviate progression of organ dysfunction and improve prognosis [6]. Although there are several Indian studies, we have scarcity of such study in Eastern India [7, 8]. The present study aids to those in analyzing spectrum of maternal ICU admission and their outcome in a tertiary referral hospital and suggests ways to improve critical obstetric care.

Aims and Objectives

1. To analyze the spectrum of obstetric ICU admissions and study their outcome in terms of morbidity and mortality.
2. To suggest ways to improve critical obstetric care.

Materials and Methods

The present study was a retrospective descriptive study undertaken in Kalinga Institute of Medical Science and Pradyumna Bal Memorial Hospital, Bhubaneswar, a 1200-bedded tertiary care hospital with 90 beds in the Department of Obstetrics and Gynecology. The hospital has a 30-bedded general ICU for medical and surgical patients. Our critically ill obstetric patients are admitted to general ICU as we do not have a dedicated obstetric ICU. This study consists of retrospective analysis of medical records of critically ill obstetric patients admitted to the ICU from January 2010 to December 2015. The protocol for our study was approved by the ethics committee of the college.

Inclusion Criteria

The inclusion criteria include all obstetric patients admitted in the intensive care unit due to pregnancy or within 6 weeks of delivery or any problem related to termination of pregnancy as well as ectopic pregnancy.

Exclusion Criteria

The exclusion criteria include non-obstetric female patients admitted to the ICU.

The data for analysis included age, parity, booking status, diagnosis, mode of delivery, indication for ICU admission, intervention in ICU, length of ICU stay, complications, number of organ system affected, presence of existing disease, interventions, and interventionists involved in the management. The data were entered and analyzed in MS EXCEL in terms of numbers, percentage, and mean \pm standard deviation (SD). Chi square test was used to find statistical significance, a

Table 1 Age distribution

Age range in years	Number	Percentage
16–20	4	7.55%
21–25	11	20.75%
26–30	27	50.94%
31–35	3	5.66%
36–40	7	13.2%
41–45	1	1.89%

P value of less than 0.05 was considered statistically significant.

Observations and Results

During the study period out of 4681 deliveries, 53 patients were admitted to the ICU which constituted 1.19% of the total deliveries. Mean age of the study group was 28.25 years with a standard deviation of ± 5.18 , the youngest being 19 years and oldest was 42 years (Table 1). In our study, antenatal admissions were more than the postnatal admissions (83.01% vs. 16.98%) (Table 2). The indication for admission in the ICU was broadly categorized into 2 groups, obstetric and non-obstetric. Many of them had more than one indication and causes were overlapping within the group as well as between the two groups. However, taking the primary diagnosis into consideration, majority of our patients belong to the obstetric group (83.01%) (Fig. 1). Obstetric causes were defined as specific pregnancy-related conditions, which occurred during pregnancy or within 42 days in the postpartum period. Hypertensive disorders of pregnancy constituted the commonest obstetric cause for admission ($n = 24$). Of the non-obstetric causes, majority had cardiac problem (9.45%) followed by pulmonary cause (3.77%) (Table 3).

Obstetric hemorrhage that had abnormal placentation included *morbidly adherent placenta* = 1, *abruptio placenta* =

Table 2 Antenatal vs. postnatal

Status	Number	Percentage
Antenatal		
Primigravida	15	28.301
Second gravida	12	22.641
Multigravida	8	15.094
Postnatal		
Para-1	8	15.094
Para-2	6	11.320
Multipara	4	7.547

Table 3 Primary diagnosis at ICU admission

Obstetric causes	No.	Non-obstetric causes	No.
Hypertensive disorder of pregnancy	24	Cardiac causes	5
PIH	6	Arrhythmia	2
Preeclampsia	9	Mitral stenosis	3
Eclampsia	8		
HELLP	1		
Obstetric hemorrhage	16	Pulmonary	2
APH+PPH	9	Pulmonary embolism	1
Rupture ectopic	7	Asthma	1
Rupture uterus	1	Hematological	2
Sepsis	3	Sickle cell anemia	2
Septic abortion	1		
Chorioamnionitis	1		
Puerperal Sepsis	1		

PIH pregnancy-induced hypertension, *HELLP* hemolysis, elevated liver enzymes, low platelet count, *APH* antepartum hemorrhage, *PPH* postpartum hemorrhage

1, placenta previa = 2, and retained placenta = 2. There was 1 case of maternal death who died due to complications of septic abortion and multiorgan failure. The majority of 33 patients (62.26%) had no additional comorbidities. However, 20 patients (37.74%) had additional problems like severe anemia, sepsis, cardiac illness, diabetes, thyroid disorders, sickle cell anemia, asthma, pulmonary arterial hypertension (PAH), and epilepsy. The mean duration of ICU stay was 2.19 ± 1.58 days and median was 2 days. The mean duration of hospital stay was 11.11 ± 13.44 days and median was 8 days (Fig. 2). Both ICU and hospital stay increased particularly in the presence of sepsis and sickle cell disease as compared to others (Table 4). Of those admitted in the ICU, cesarean section was the most common mode of delivery, and 86.95% of the hypertensive

women underwent cesarean section (Table 5). The most common intervention done in the ICU was transfusion of blood or blood components (43.39%) followed by magnesium sulfate infusion (32.07%). Mechanical ventilation was needed in 13.20% of the cases (Fig. 3). Apart from obstetricians and intensivists, various multidisciplinary inputs involved in the patient management were anesthesiologists, physician, cardiologists, ophthalmologists, surgeon, nephrologist, ENT, neurosurgeon, physiotherapist, and gastroenterologist (Table 6).

Discussion

Complications during pregnancy or in the postpartum period can be life-threatening and require intensive care. In our study, 1.19% of the total deliveries required ICU which was consistent with the study of Wakankar et al. [9] and Muench et al. [10] The mean age of obstetric ICU patients was 28.25 ± 5.18 years which was comparable to the mean age of 28 ± 6 years reported by Demirkiran [11] and 26 ± 6 years by Kilpatrick [12]. In our study, majority (58%) were booked cases which was similar to the study of Wakankar et al. where booked case constituted 55.29% [9]. Similar to antepartum admissions of 78.23% and 72.4% quoted by Wakankar et al. [9] and Baloch et al., [13] our study also revealed higher antenatal than postnatal admission (66.03% vs. 33.96%). The high rates of antenatal admissions may be attributed to the increased incidences of hypertensive disorders of pregnancy.

In our study, obstetric causes for ICU admission were 83.01% and non-obstetric causes were 16.98% which was almost similar to those reported by Reddy KH et al. where obstetric cause was found in 75% of cases [2]. Among obstetric causes, hypertensive disorders of pregnancy (45.28%) formed the major chunk of all the ICU admissions,

Fig. 1 Primary diagnosis at ICU admission

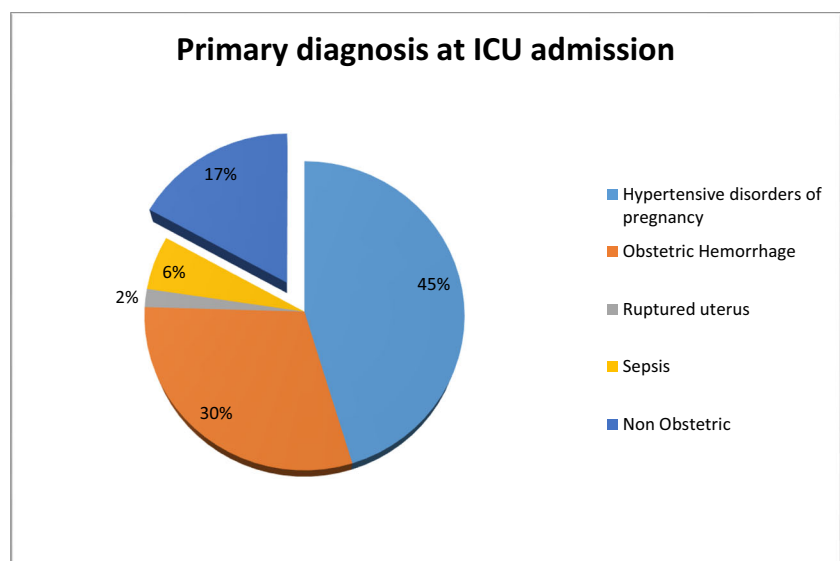


Table 4 Causes vs. duration of ICU and hospital stay

Indication of ICU admission	Duration of ICU stay in days		Duration of hospital stay in days	
	Range	Median	Range	Median
Obstetric causes				
1. Hypertensive disorders of pregnancy	1–8	2	4–50	7.5
2. Obstetric hemorrhage	1–4	1	1–62	6.5
3. Ectopic pregnancy	1–4	2	4–8	6
4. Sepsis	2–6	4	7–16	14
Non obstetric causes				
1. Cardiac	1–3	1	4–73	8
2. Pulmonary	1–2	1	7–15	8.5
3. Sickle cell disease	2–4	3	11–62	36.5
In the presence of additional comorbid condition	1–8	2	3–73	7.5

preeclampsia being the maximum. Similar findings were also observed by other study by Reddy KH where hypertensive disorders of pregnancy constituted 42.4% [2]. The second most common cause was obstetric hemorrhage which contributed to 30.18% which was almost similar to Poornima et al. (27.7%). [14] A total of 37.74% admitted in the intensive care unit had associated comorbidities while Waterstone et al. noted the same in 38%. [15] Cardiac disease and diabetes mellitus were the common associations.

Similar to the study of Orsini et al. [16], the mean duration of ICU stay in the present study was 2.19 ± 1.58 and there was no significant correlation between the age and booking status with the duration of ICU stay. However, the median duration of ICU as well as hospital stay is likely to increase in the presence of additional comorbid conditions such as sepsis and sickle cell disease. In present study, dialysis was done in 3.77%. Percentages reported by other studies were 2% in Leung et al. [5] and 5.92% in Baloch et al. study [13]. A total of 43.39% of patients in the current study had hemodynamic instability which was consistent with those reported by Bibi et al. (40%). [17] Mechanical ventilation was required in 13.20% of the cases which was similar to the finding of Reddy et al. [2] In our study, 17% of patients delivered vaginally and 64.2% of cases required cesarean section which is

comparable to the findings of Waterstone et al. [15] In the current study, incidence of laparotomy and obstetric hysterectomy were 15.09% and 1.9% respectively. Similar percentage of obstetric hysterectomy (7%) was also reported by Bibi et al. [17] The management of these obstetric patients often requires multidisciplinary input. Besides the obstetricians and intensivist who were involved in all cases, the most frequently consulted speciality in the current study was anesthesiologists (51.8%) followed by physician (23.5%).

ENT, neurosurgeon, physiotherapist, and gastroenterologist were the least consulted one (1.2% each). Our study showed lower mortality rate (1.88%) which was lower than Kilpatrick et al. (2.3%) [12], whereas maternal deaths reported by some other studies were quite higher (25%) in Karnad, [18] 21.6% in Munnur, [19] and 27% in Sheela CN [20]. Lower mortality rate in our study could be due to a greater number of booked cases admitted and presence of a government hospital and a medical college in the city which caters most of the poor, unbooked, and late referrals. The lower mortality rate of our ICU admissions also reflects team approach, good infrastructure in ICU, and proper antenatal management due to booked status. Henceforth, it is now important to actually ascertain the

Table 5 Mode of delivery and surgical intervention

Surgical interventions	Number	Percentage
LSCS	34	64.2%
NVD	9	17%
Laparoscopic/laparotomy salpingectomy	7	13.20%
Obstetric hysterectomy	1	1.9%
MTP	1	1.9%
B-lynch and internal iliac art ligation	1	1.9%

LSCS lower segment cesarean section, NVD normal vaginal delivery, MTP medical termination of pregnancy

Table 6 Interventionists

Interventionists	Percentage	Frequency (n)
Physician	23.5%	20
Anesthesia	51.8%	44
Cardiologist	11.8%	10
Nephrologist	5.66%	3
Surgery	3.5%	3
Neurosurgery	1.2%	1
Physiotherapist	1.2%	1
Gastroenterologist	1.2%	1

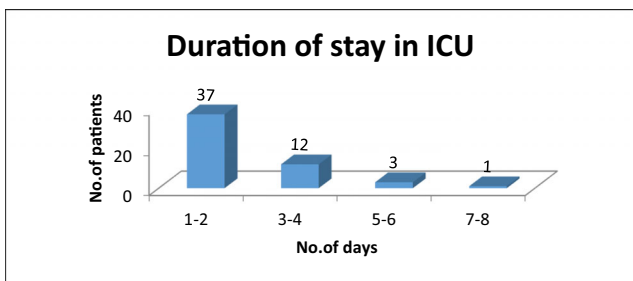
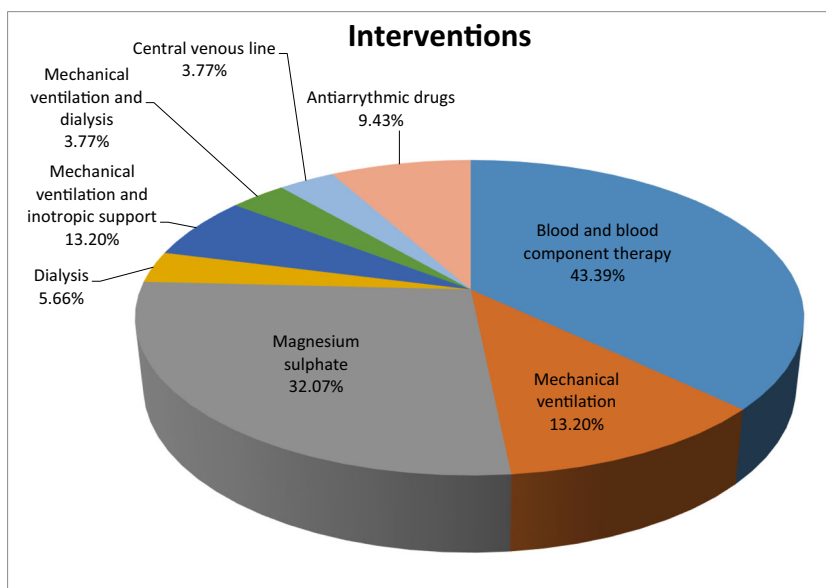


Fig. 2 Duration of stay in ICU

place for maternal mortality as an indicator of obstetric care in such analysis. Also identifying and targeting the focus areas of attention would aid in the improvement of maternal and fetal well-being. Midwives are often the first professionals to detect clinical deterioration in a woman’s condition in many western and European countries. Midwives’ education and training equip them with specialist knowledge and skills including an in-depth understanding of the physiological/psychological changes occurring during pregnancy and the puerperium, the ability to monitor fetal well-being, detect abnormalities such as postnatal uterine atony, and support breastfeeding [21]. The Midwives in Teaching (MINT) study commissioned by the UK Nursing and Midwifery Council (NMC) identified that newly qualified midwives would have preferred more educational input regarding the care of women with high-risk pregnancies and those requiring OHDC during their training [22]. But midwives receiving obstetrics HDU/ICU training face the challenge of maintaining their competence if they do not encounter this cohort of critically ill women on a regular basis [23].

Fig. 3 Interventions required in ICU



Conclusion

Outcome of critically ill obstetric patients is greatly influenced by not only the presence but also its proper functioning where a well-organized protocol-based systematic approach is followed in the patient management. But unfortunately, in a developing country like India, most of hospitals lack it either in quantity or quality. In early admission, proper and timely management of critically ill obstetric patients in the ICU decreases maternal mortality and morbidity. Physicians and other stakeholders such as anesthesiologists, cardiologists, ophthalmologists, and surgeons in the intensive care unit should be familiar with the complications of pregnancy and should work closely with the obstetricians in order to improve maternal outcome.

A dedicated obstetric ICU in the labor complex itself which ensures round the clock presence of an obstetrician who has better understanding of the complex maternal pathophysiology could be a way forward to optimize the critical care for mothers. A special training or fellowship program in obstetric critical care may be of great help to improve the standard of practice.

The work burden to intensive care may be reduced by targeting two most common causes of ICU admission by improving the antenatal care of hypertensive disorders during pregnancy and by reducing the prevalence of hemorrhagic complication.

Limitations As this was a retrospective study based on data collected from a single center, the results may not be suitably extrapolated onto a larger population. This brings about the need of larger multi-centric studies so as to identify the focus areas of attention in critical care in order to optimize maternal outcome.

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Author's Contributions Dr. Pramila Jena—chief mentor, PI, data compilation.

Dr. Afsan Tahaseen—data collection.

Dr. Karan Khandelwal—data collection.

Dr. Jagannath Mishra—scrutinizer, data compilation, manuscript preparation.

Data Availability Data regarding all our works done for this study is available on request.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Committee Approval This study was approved by the Institutional Ethics Committee, KIMS, KIIT University Bhubaneswar, Odisha, India, reference number KIMS/KIIT/IEC/64/2016.

Consent Consent was obtained from all patients participating in the study.

References

- Chawla S, Nakra M, Mohan S, Nambiar BC, Agarwal R, Marwaha A. Why do obstetric patients go to the ICU? A 3-year-study. *Med J Armed forces India*. 2013;69(2):134–7.
- Reddy KH, Muduy S, Pallavi S, Dasari VS. Obstetric ICU admissions—a clinical audit. *International journal of medical science and clinical inventions*. 2015;3(2):773–83.
- Soubra SH, Guntupalli KK. Critical illness in pregnancy: an overview. *Crit Care Med*. 2005;33(10 suppl):248–55.
- Making pregnancy safer. WHO regional office for Europe. Website: <http://www.euro.who.int/pregnancy>. [accessed 2008 sep].
- Leung NYW, Lau ACW, Chan KKC, Yan WW. Clinical characteristics and outcomes of obstetric patients admitted to the intensive care unit: a 10-years retrospective review. *Hong Kong Med J*. 2010;16:18–25.
- Ebirim LN, Ojum S. Admissions of obstetric patients in the intensive care unit: a 5 year review. *Journal of Medicine and Medical Sciences*. 2012;3(11):741–4.
- Dasgupta S, Jha T, Bagchi P, Singh SS, Gorai R, Choudhury SD. Critically ill obstetric patients in a general critical care unit: a 5 years' retrospective study in a public teaching hospital of Eastern India. *IJCCM*. 2017;21(5):294–302.
- Pattnaik T, Samal S, Behuria S. Obstetric admissions to the intensive care unit: a five year review. *Int J Reprod Contracept Obstet Gynecol*. 2015;4:1914–7.
- Wakankar R, Patankar A, Humne A, Khadse A. Study of obstetric cases admitted in ICU India. *SAS J Surg*. 2015;1(1):11–7.
- Muench MV, Baschat AA, Malinow AM. Analysis of disease in the obstetric intensive care unit at a university referral center: a 24-month review of prospective data. *J Reprod Med*. 2008;53:914–20.
- Demirkiran O, Dikmen Y, Utku T, Urkmez S. Critically ill obstetric patients in the intensive care unit. *Int J Obstet Anesth*. 2003;12(4):266–70.
- Kilpatrick SJ, Matthay MA. Obstetric patients requiring critical care. *Chest*. 1992;101(5):1407–12.
- Baloch R, Jakhriani NK, Zeb E, Hafeez S, Abassi M, Abassi FN. Pattern and outcome of obstetric admissions to the surgical intensive care unit—a ten years study. *J Surg Pak*. 2014;15(4):171–6.
- Poomima B, Bhat R, Mahesha H, Navada, Rao SV. Evaluation of obstetric admissions to intensive care unit of a tertiary referral center in coastal India. *Indian J Crit Care Med*. 2013;17:34–7.
- Waterstone M, Bewley S, Wolfe C. Preliminary results from a one-year prospective study of the incidence of severe obstetric morbidity. *Br J Obstet Gynaecol*. 1998;105:35.
- Orsini J, Butala A, Diaz L, Muzylo E, Mainardi C, Kestell P. Clinical profile of obstetric patients admitted to the Medical Surgical Intensive Care Unit (MSICU) of an Inner-City Hospital in New York. *J Clin Med Res*. 2012;4:314–7.
- Bibi S, Memon A, Sheikh JM, Qureshi AH. Severe acute maternal morbidity and intensive care in a public sector university hospital of Pakistan. *J Ayub Med Coll Abbottabad*. 2008;20:109–12.
- Karnad DR, Guntupalli KK. Critical illness and pregnancy: review of a global problem. *Crit Care Clin*. 2004;20:555–76.
- Munnur U, Karnad DR, Bandi VD, Lapsia V, Suresh MS, Ramshesh P, et al. Critically ill obstetric patients in an American and an Indian public hospital: comparison of case mix organ dysfunction, intensive care requirements and outcomes. *Intensive Care Med*. 2005;31:1087–94.
- Sheela CN, Mhaskar A, Mhaskar R. Critical care in obstetrics—a 3 year review in a tertiary referral hospital. *J Obstet Gynecol India*. 2004;54:155–7.
- Nursing and Midwifery Council. Standards for pre-registration midwifery education. London: NMC; 2009.
- Fraser D, Avis M, Mallik M, Collaborative project team. Evaluation of whether midwife teachers bring a unique contribution particularly in the context of outcomes for women and their families—the MINT project. London: NMC; 2010.
- Billington M, Stevenson M, editors. Critical care in childbearing for midwives. Oxford: Blackwell Publishing; 2007.

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