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## Study to assess the clinical profile of antenatal and postpartum women requiring admission to the ICU: A retrospective analysis

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### Abstract

**Aim:** to evaluate the incidence, clinical profile of antenatal and postpartum women requiring admission to the ICU the interventions required in these women and final outcome.

**Material and methods:** This retrospective observational study was done in the Department of Anaesthesia, Metro Hospital and Cancer Research Center, Jabalpur, Madhya Pradesh, India. Data were recorded and analyzed for each patient: age, parity, primary diagnosis (obstetric or non-obstetric e.g. community-acquired pneumonia, rheumatic heart disease) responsible for the patient's critical illness, indication of ICU admission, obstetric interventions performed, critical care interventions performed during ICU stay (mechanical ventilation, central venous catheterization, invasive arterial pressure monitoring, hemodialysis), duration of mechanical ventilation, length of ICU stay and outcome of patient.

**Results:** During the study total 200 obstetric patients were admitted to the ICUs (4.44% of total ICU admissions). There were 12000 deliveries in this period, and the ICU admission rate was 16.30 per 1000 deliveries. The mean maternal age (in years) was  $24.26 \pm 4.78$  (mean  $\pm$  standard deviation). Primigravida (55%) were more as compared to multigravida (45%). Only 16% patients were in antepartum period while majority of patients (84%) were admitted during postpartum period. The main obstetric indications for ICU admission were pregnancy-induced hypertension (15%) followed by obstetric haemorrhage (9%) and community acquired pneumonia (7%), other indications were valvular heart disease (5%) and monitoring (6.5%). In the present study maternal mortality among the women admitted to ICU was 16%. The leading cause of maternal death was obstetric haemorrhage (28.13%) followed by pregnancy induced hypertension (21.87%). An ICU intervention during the stay of the patients in terms of mechanical ventilation was used in 135 (67.5%) cases.

**Conclusion:** A high quality multidisciplinary care is required in complicated pregnancies for safe motherhood. So, there is a need for dedicated ICU for obstetric patients.

**Keywords:** Critical care, haemorrhage, obstetric, pregnancy-induced hypertension

### Introduction

Developing countries account for 99% of global maternal deaths. According to the data of world health organization 2010, the incidence of global maternal mortality ratio (MMR) was 210 maternal deaths per 100,000 live births. India accounts for 19% (56,000) of global maternal deaths. Despite some progress in providing improved healthcare to pregnant women in the last decade an alarmingly high MMR still remains a challenge in developing countries. The major causes of pregnancy-related complications are severe bleeding after childbirth, infections, pregnancy-induced hypertension, and unsafe abortion<sup>[1]</sup>. The incidence of pregnant women admitted to intensive care unit (ICU) in developed countries is 2-4 per 1,000 deliveries as compared with 2-13.5 per 1,000 deliveries in developing countries<sup>[2]</sup>. Critically ill obstetric patients account for as much as 7% of the ICU admissions in developing countries, while they account for only 0.2%–0.9% in developed countries<sup>[3, 4]</sup>. The reason for small percentage of ICU admission in developed countries is because of easy access to specialized centers for obstetric services and better healthcare facilities<sup>[6]</sup>. One study done in Finland shows critical care admission of obstetric patients to be in the range of 0.7%–2.1% per 100 deliveries with 0% mortality<sup>[1]</sup>. In contrast, one study from the tertiary care government institute in South India, catering to 1.7 million patients per year, shows admission of obstetric patient to be around 11.6% of total admission to critical care<sup>[6]</sup>. When compared with other South Asian developing countries, Pakistan has the highest fertility rate of 3.4 births/woman and lowest public health expenditure of 0.8% of gross domestic product.

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Due to this imbalance, out of 5 million births taking place annually, only 205,000 women receive any form of trained healthcare [7]. India accounts for 19% of global maternal deaths. Admission of pregnant women to an ICU is considered as an objective marker of severe maternal morbidity [8]. The aim of the present study evaluate the incidence, clinical profile of antenatal and postpartum women requiring admission to the ICU the interventions required in these women and final outcome.

### Material and Methods

This retrospective observational study was done the Department of Anaesthesia, Metro Hospital and Cancer Research Center, Jabalpur, Madhya Pradesh, India after taking the approval of the protocol review committee and institutional ethics committee.

### Methodology

The medical records of all obstetric patients (pregnant or within 6 weeks postpartum) admitted to both the ICUs during the study were analyzed along with simultaneous analysis of ICU databases. The following data were recorded and analyzed for each patient: age, parity, primary diagnosis (obstetric or non-obstetric e.g. community-acquired pneumonia, rheumatic heart disease) responsible for the patient's critical illness, indication of ICU admission, obstetric interventions performed, critical care interventions performed during ICU stay (mechanical ventilation, central venous catheterization, invasive arterial pressure monitoring, hemodialysis), duration of mechanical ventilation, length of ICU stay and outcome of patient. This analytical data was compared with total number of ICU

admissions, total number of deliveries in this period of time. The data were analysed statistically by using percentage.

### Results

During the study total 220 obstetric patients were admitted to the ICUs (4.68% of total ICU admissions). Out of 220, 78 women were admitted in Medical ICU and 142 women were admitted in surgical ICU. There were 13500 deliveries in this period, and the ICU admission rate was 16.30 per 1000 deliveries. The mean maternal age (in years) was  $23.87 \pm 4.36$  (mean  $\pm$  standard deviation) (Table 1). Primigravida (55.91%) were more as compared to multigravida (44.09%). Only 17.27% patients were in antepartum period while majority of patients (82.73%) were admitted during postpartum period (Table 1). The main obstetric indications for ICU admission were pregnancy-induced hypertension (14.09%) followed by obstetric haemorrhage (9.09%) and community acquired pneumonia (7.27%) (Table 2). Other indications were valvular heart disease (5%) and monitoring (6.82%). In the present study maternal mortality among the women admitted to ICU was 13.64%. The leading cause of maternal death was obstetric haemorrhage (26.67%) followed by pregnancy induced hypertension (20%) (Table 3). An ICU intervention during the stay of the patients in terms of mechanical ventilation was used in 141 (64.09%) cases (Table 4). Among preventable infectious diseases, 5 ANC admissions in medical ICU were for swine flu out of that 1 women died, 2 women admitted for pulmonary tuberculosis, 2 women for dengue out of that 1 died and 1 admitted for malaria. Average stay in days of survivors was 5 and of non- survivors was 4 days.

**Table 1:** Distribution of deliveries, total ICU admissions, parity, Age

Parameter	Numbers	Percentage
Deliveries	13500	
ICU admissions	4700	
Obstetric admissions to ICU	220	
Obstetric admissions to ICU per 1000 deliveries		16.30
Obstetric admissions to ICU as percentage of total ICU admissions		4.68
Primigravida	123	55.91
Multigravida	97	44.09
ANC cases	38	17.27
PNC cases	182	82.72
cases delivered outside before admission	5	2.27
Mean age of obstetric admissions to ICU in years (Mean $\pm$ SD)	23.87 $\pm$ 4.36	
Age distribution, years (n=220)	Below 25 years (152)	
	25-30 (41)	
	Above 30 years (27)	

**Table 2:** Distribution of causes of ICU admissions

Primary diagnosis	Number	Percentage
PPH	20	9.09
PIH	31	14.09
Pneumonia	16	7.27
Valvular heart disease	11	5
Ruptured ectopic	2	0.9
Ruptured uterus	2	0.9
APH	8	3.63
Cardiomyopathy	2	0.9
Acute kidney injury	4	1.82
Eclampsia	8	3.64
Septicemia	7	3.18
Monitoring	15	6.82

**Table 3:** Number of deaths related to primary diagnosis

Primary diagnosis	Number of deaths=30	Percentage
PIH	6	20
PPH	8	26.67
Septicemia with MODS	3	10
Cardiomyopathy	2	6.67
ANC with pneumonia	3	10
ANC with severe anaemia	2	6.67
ANC with dengue	2	6.67
ANC with swine flu	1	3.33
Others	3	10

**Table 4:** ICU intervention

Procedure	Number of patients	percentage
Invasive ventilation	141	64.09
Dialysis	4	1.82

## Discussion

In the present study the mean maternal age (in years) was  $23.87 \pm 4.36$  and 69.09 percent patients from below 25 years age this finding was correlate with other contemporary Indian studies, but studies from abroad report a higher maternal age [9]. Although advanced maternal age has not been shown to be uniformly associated with ICU admissions and a median age of 30 years is consistent with birth age patterns in developed countries [10]. The worth noticing point in Indian studies is the need of critical care in the patients under thirty. Socioeconomic factors, early marriages, less education and poor obstetric care in certain remote parts of the country may all contribute to this. Other studies report a higher percentage of multiparous admissions. Present study reports Primigravida (55.91%) were more as compared to multigravida (44.09%). This probably correlates with a high percentage of patients being admitted with complications of PIH in present ICU, primiparity being a known risk factor of PIH [11]. in our study only 17.27% patients were in antepartum period while majority of patients (82.73%) were admitted during postpartum period, that is almost uniform among all studies from India and abroad [12]. Bhadate *et al.* reported a very high antepartum admission percentage of 66.39%, but their report is from an exclusively medical ICU, where most admissions were for indirect obstetric indications with hepatitis E in pregnancy being the most common (36.8%). Pollock *et al.* in their systematic review, showed that there was no difference in ICU admission per 1000 deliveries between developed (median 3 [IQR 0.7-8.8]) and developing (median 2.7 [IQR 1.3-3.5]) countries [13]. The ICU utilization rate of 16.30 per 1000 deliveries in present study, albeit low, is more or less in keeping with the values from developing countries studied in the review and other recent Indian studies, which mostly reported a rate below 10 per 1000 deliveries. However, differences in case mix, obstetric and critical care protocols, facilities and bed strengths may be responsible for a very high ICU utilization rate of 28 and 54 per 1000 deliveries reported in two Indian studies [14].

Considering the well-recognized differences in access to health-care facilities, severity of illness at the time of seeking medical help, and adequacy of ICU beds between developed and resource-limited countries, the similarity between present ICU admission rate and those from developed countries may appear paradoxical [15].

However, this may be explained by the shortage of beds in present unit, compelling us to sometimes manage patients

not needing very aggressive supports in other intensive care areas of the hospital on emergent basis (e.g., surgical ICU, trauma ICU) and in the absence of a dedicated obstetric ICU, even in the labor room recovery with coordinated efforts of obstetric, Anesthesiology, and critical care teams. This subset of patients was not included in the analysis, and it might be a limitation of present study. The most common primary diagnosis leading to critical care admission is between obstetric hemorrhage and PIH in almost all the studies from India and abroad [16].

The ICU patients had PIH as the most common primary diagnosis followed by obstetric hemorrhage. In the study by Togonal *et al.* although the main primary diagnosis for ICU admission was PIH, the main cause of death was hemorrhage [17].

Sepsis is also being responsible for ICU admissions in obstetric patients worldwide. Even in studies from developed countries, significant percentages of obstetric critical care admissions 10%, 5%, 6.6%, 7.1% were due to sepsis [18]. Two Indian studies report a very low rate of sepsis 1.6%, 2.45% which is comparable to present study which is 3.18%. Gombar *et al.* even reports a sepsis admission rate as high as 27.15%. The ICU obstetric mortality rate of 13.64% in present study matches with the contemporary Indian studies. A low mortality rate of 6.5% reported by Harde *et al.* from a post anesthesia ICU may not be a representation of maternal mortality in a general ICU and a study by Bhadade *et al.* from the medical ICU of the same institute reports a high maternal mortality rate of 30.3% [19].

Most common cause of referral to this institution was unavailability of blood and blood products followed by unavailability of speciality doctor's team. A high rate of invasive ventilation (64.09%) in the present study reflects the severity of illness of patients admitted in present ICU. Overall, the ventilation rate among obstetric patients is variable in studies from outside India with Zwart *et al.* reporting a rate of 34.8%, Crozier and Wallace 45%, Sriram and Robertson 61%, and the team of Togonal *et al.* a rate as high as 85%. Present high ventilation rate nearly matches the Indian report by Ashraf *et al.* which is 85% but is higher than that reported in many other Indian studies [20].

The low percentage of patients needing hemodialysis (1.82%) in present study is probably explained by the finding of cardiovascular and respiratory failures as the most common organ failures. In general, the Indian studies report a hemodialysis rate of <10%, with some reporting slightly higher percentages than ours (7.7%, 7.4% while Jain M *et al.* similar to present study (2.5%) [21]. Only, Bhadade *et al.* reported an exceptionally high percentage of 38.88% from exclusively medical ICU. It has been recognized that the maternal mortality among critically ill obstetric patients in developing countries is higher than developed nations. Multiple socioeconomic and healthcare-related factors are responsible for this disparity. Studies by Sriram and Robertson and Crozier and Wallace did not report even a single maternal death, and the mortality rate was consistently below 5% in other reports from ICUs of developed countries [22].

Like many studies from India and abroad obstetric hemorrhage with organ failure was the major cause of mortality in present study, PPH (26.67%) comprised most of these hemorrhage fatalities [23]. Other major causes of mortality in present study were complicated PIH (20%) and

sepsis with organ failure (10%).

Due to the quick reversibility of illness in most of the young obstetric patients, the average length of ICU stay is in general short in this patient group. The median length of ICU stay (in days) was 4.5 in the present study which nearly matches many other studies from around the world and India. However, an even shorter length of ICU stay of below 2 days has also been reported both from India and abroad. The length of ICU stay among non survivors in present study (in days) was 5 suggests fast rate of complications in these patients demanding more vigilant and quick decisions over treatment modalities in these patients. A general limitation of studies on obstetric critical care is the controversy regarding applicability of the most commonly used ICU severity scoring systems, for example, Acute Physiology and Chronic Health Evaluation or Simplified Acute Physiology Score among critically ill obstetric patients and hence, like a recently published study, authors also did not use any scoring system to assess severity of illness or predict mortality<sup>[24]</sup>.

### Conclusion

A high quality multidisciplinary care is required in complicated pregnancies for safe motherhood. So, there is a need for dedicated ICU for obstetric patients.

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