

DOI: 10.5455/2320-1770.ijrcog20140338

## Research Article

# Maternal and perinatal outcomes in critically ill obstetric patients

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**Received:** 10 February 2014

**Accepted:** 16 February 2014

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## ABSTRACT

**Background:** The present study was done to analyze the outcome of critically ill antenatal and postnatal women in the intensive care unit (ICU) of a tertiary care teaching hospital. The study was done to identify and analyze the risk factors that influence maternal-perinatal morbidity and mortality.

**Methods:** All the obstetric patients admitted to ICU during January 2009 to December 2013 were analyzed retrospectively. The indications for transfer to ICU, obstetric and non-obstetric causes were evaluated. Mortality Probability Model (MPM2) score was calculated and risk of mortality estimated. The course and complications during hospital stay were noted.

**Results:** 57 obstetric patients were admitted during the above mentioned period representing 5/1000 deliveries. Postpartum patients outnumbered antenatal women (31 vs. 26). Obstetric causes- preeclampsia, hemorrhage and sepsis were common indications for admissions. Respiratory failure and the need for mechanical ventilation was the most common reason for critical care. Maternal mortality was 28% and the perinatal mortality was 50%.

**Conclusions:** Pregnancy-induced hypertensive disorders and hemorrhage were the major risk factors apart from pneumonia and hepatitis that continue to take toll in obstetric patients. Adequate antenatal care, increased vigilance of women during pregnancy for subtle signs and symptoms, early transfer to tertiary centre and aggressive management to prevent complications can bring about the desired reduction in maternal-perinatal morbidity and mortality.

**Keywords:** Critically ill mothers, Intensive care, Mechanical ventilation, Pregnancy complications

## INTRODUCTION

A multitude of profound physiologic hemodynamic changes occur during pregnancy. The substantial increase in blood volume, cardiac output and respiratory changes are few among the many alterations in physiology. These major hematologic, cardio respiratory changes and the related pathologies are unique to pregnancy. Certain non-obstetric medical conditions either present differently or behave aggressively during pregnancy. Various therapeutic modalities may have their effect on the developing fetus and influence the plan for delivery.<sup>1</sup>

Critically ill obstetric patients contribute about 2-9/1000 deliveries.<sup>1</sup> These patients are usually young and previously in good health. However the potential catastrophic complications are real and despite the therapeutic advances in the last few decades, maternal morbidity and mortality continue to occur. This may be due to the complications of pregnancy, aggravation of pre-existing medical illness or complications of the delivery.

In India, we have very few studies on critically ill obstetric patients.<sup>2-4</sup> Additional studies will help in increasing awareness, care, formation of a dedicated obstetric Intensive Care and outcome in developing

countries like ours. Therefore through this study, we intend to

1. Review the maternal and perinatal outcome of pregnant patients and postnatal mothers up to 42 days of delivery who needed admission to Medical Intensive Care Unit in a tertiary care teaching hospital.
2. Identify the preventable factors in improving maternal morbidity and mortality.

## METHODS

Retrospective analyses of medical records of Obstetric patients who were admitted to Medical-Surgical Intensive Care Unit (ICU) of a tertiary care teaching hospital in Coimbatore, Tamil Nadu, India during January 2009 to December 2013 (i.e. 5 years).

These patients were either antenatal at the time of admission to ICU or were within 42 days of their delivery.

The patient profiles, clinical characteristics, Glasgow Coma Scale at admission, indications for transfer to MICU were analyzed. Investigations noted with particular emphasis on impaired hematological and biochemical values of liver and renal function tests, serum electrolytes, Arterial Blood gases.

Presence of ARDS, hepatic failure, renal failure, need for mechanical ventilation and the complications during hospital stay were noted. Outcome of the mother and fetus were also noted.

Statistical significance was calculated using t-test.

The Institute's Ethical Committee approval was taken to retrieve the medical records.

## RESULTS

During the study period, 57 obstetric patients needed admission to the Medical-Surgical ICU. There were a total of 10,858 deliveries from Jan'2009 to Dec' 2013. These represent 5.3/1000 deliveries. Out of these 57 patients, 26 (45.62%) were antenatal at the time of admission and 31 (54.38%) were postnatal. The mean age of the patients was 26.77 with a range of 19-35 years.

Among the 26 antenatal patients, 2 patients were discharged undelivered while the remaining 24 had termination of pregnancy either by vaginal or cesarean route.

65.5% of the patients were admitted after 28 weeks possibly because of physiologic increase in blood volume and cardiac output are at a maximum at this gestational age and any morbidity secondary to obstetric or non-obstetric pathology can decompensate.

**Table 1: Antepartum admissions to ICU.**

Gestational age at admission	Number of cases
1 <sup>st</sup> trimester (up to 12 weeks)	2 out of 26 (7.6%)
2 <sup>nd</sup> trimester (13 to 28 weeks)	7 out of 26 (26.9%)
3 <sup>rd</sup> trimester (29-40 weeks)	17 out of 26 (65.5%)

**Table 2: Postnatal admissions to ICU.**

Admitted postnatal	Discharged stable	Expired
31/57 (54.38%)	21/31 (67.75%)	10/31 (32.25%)

Out of the 31 postpartum patients, 28 patients were admitted within 7 days of delivery, while remaining 3 were within 6 weeks post-delivery. 10 patients had delivered by vaginal route while 17 underwent Cesarean for reasons ranging from Elective repeat LSCS under regional anesthesia to HELLP syndrome. 4 patients were referred after cesarean hysterectomy for uncontrolled hemorrhage. The causes for admission to hospital and the reason for shifting to medical-surgical ICU are as follows (Table 3).

Obstetric causes predominated with 54% of patients of which severe preeclampsia/eclampsia was the most common cause while non-obstetric causes were the reasons for admission in 46% of patients. Of the eleven patients admitted with community acquired pneumonia and two of the patients suffering from H1N1 viral illness. Hepatitis was next common cause (4 patients) with Hepatitis E in 2 patients. Pregnancy could have made these diseases exacerbate.

Respiratory failure and coagulopathy were the most common reasons for admission to ICU, accounting for 52%. Neurologic complications were responsible for 16% of ICU admissions. The most common underlying medical disorder in these patients was anemia in 27 patients (47%) (Table 4).

We assessed the risk of maternal death at the time of admission to the ICU using MPM II score (Mortality probability model).<sup>5</sup> It provides risk rates based not only on physiologic variables but also takes into consideration the use of CPR, acute and chronic diagnoses and need for ventilator support.

The mean predicted mortality at admission of all the critically ill obstetric patients was 18.94. The mean predicted death rate as estimated in patients who expired was 39.84 whereas the mean in patients who were discharged in stable condition was 10.52.

**Table 3: Primary diagnosis and reason for admission to ICU.**

	Cause (number of cases)	Respiratory failure	Hemo-dynamic instability	Coagulation failure	Neurologic dysfunction	Renal failure
Obstetric cause (31 cases)	Preeclampsia (11)	3	2	2	2	2
	Hemorrhage (6)		2	4		
	AFLP (5)			2	1	2
	Sepsis (4)	1	1	1	1	
	Peripartum cardiomyopathy (4)	3	1			
	Hyperemesis with severe dehydration (1)					1
Non obstetric cause (26 cases)	Pneumonia (11)	11				
	Sepsis (3)	3				
	Hepatitis (4)			3	1	
	Anesthetic complication (1)		1			
	Aplastic anemia (1)			1		
	Cerebrovascular events with seizures (2)				2	
	Meningitis (1)				1	
	SLE (2)				1	1
	Angioneurotic edema (1)		1			
Total (57 cases)		22 (39%)	8 (14%)	13 (23%)	9 (16%)	5 (8%)

**Table 4: Underlying medical disorders.**

Underlying medical disorder	Number of cases (%)
Anemia	27/57 (47%)
Gestational diabetes	4/57 (7%)
SLE	2/57 (3.5%)

**Table 5: Predicted death rate according to MPM2 score.**

Predicted death rate	Number of patients discharged stably	Number of mortality patients
>81%	-	2
61-80%	-	2
41-60%	-	-
21-40%	5	5
0-20%	36	7

Applying t-test, p value was <0.01 which is significant.

Multi organ failure was the most common complication. This could have been secondary to the disease process itself or sepsis. Preeclampsia, acute fatty liver of pregnancy, hepatitis is all known to involve more than one system.

Sepsis was the next most common complication seen in patients admitted in ICU with cultures positively grown

in 12 patients with source being lung in 9 patients, urine in 4 patients and blood (4 patients).

**Table 6: Course and complications during ICU stay.**

Complication	Number of patients	Remarks
Renal failure	11	9 needed multiple hemodialysis
Sepsis	12 (3 patients had multiple organisms)	Organisms- <i>Candida</i> (5)
		<i>Acinetobacter baumannii</i> (4)
		<i>Klebsiella</i> (3)
		<i>H. influenza</i> (2)
		<i>E. coli</i>
Hepatic encephalopathy	8	
DIC	8	
Acute lung injury	9	
Multiple transfusions	8	
Multi organ failure	22	
Intracranial hemorrhage/thrombosis	5	

The micro-organisms grown from trachea were *Pseudomonas aeruginosa* (2), *Acinetobacter baumannii* (2), *Candida albicans* (2), *E. coli* (1), *Klebsiella* (1), *H. influenza* (1). This is alarming as these patients apart from being critically ill also face the risk of ventilator

associated pneumonia. *Acinetobacter baumannii* is known to be a multidrug resistant pathogen with a predilection for seriously ill in ICUs.<sup>6</sup>

Renal failure developed in 11 patients with 9 requiring renal replacement therapy.

Hepatic encephalopathy developed in 8 patients either as a complication AFLP or Hepatitis

Disseminated intravascular coagulation was seen in 8 patients secondary to the causes ranging from sepsis, hepatic failure, amniotic fluid embolism and dilutional coagulopathy. Eight patients required multiple transfusions of blood components for reasons of severe anemia, thrombocytopenia and DIC.

One patient underwent re-laparotomy for evolving rectus sheath hematoma. All, except two patients (1 with nephrotic syndrome and 1 with hyperemesis with severe hypokalemia) were artificially ventilated and monitored with central venous catheter.

There were a total of 16 maternal deaths out of 57 patients which amounts to maternal mortality ratio of 148/1,00,000 live births. This has a lot of relevance as maternal mortality is one of the qualitative indicators of healthcare and social status of women.

**Table 7: Outcome of the critically ill antepartum patients.**

Outcome	Number of cases/total
Discharged undelivered	2/26 (7.6%)
Underwent vaginal delivery	12/26 (46.15%)
Underwent caesarean delivery	4/26 (15.38%)
Underwent TOP (<28 weeks)	2/26 (7.6%)
Expired undelivered	6/26 (23.27%)

Cesarean section was done in 4 patients. The indications were:

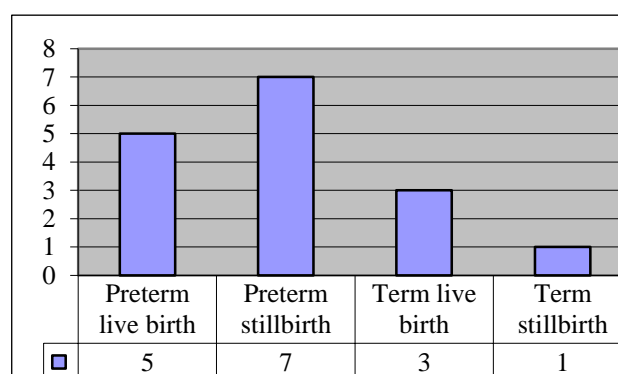
- Eclampsia - 2
- Previous cesarean with ARDS - 1
- Fetal distress in a term patient with ARDS - 1

**Table 8: The causes of maternal deaths.**

Direct causes			Indirect causes		
Cause	Number of cases	%	Cause	Number of cases	%
Hemorrhage	3	19%	Hepatitis	4	25%
Sepsis	3	19%	Cerebrovascular accidents	2	12%
Preeclampsia	1	6%	Community acquired pneumonia	3	19%
Total	7	44%	Total	9	56%

Hemorrhage, sepsis and preeclampsia with its complications continue to take toll on obstetric patients accounting for 44% of maternal deaths as direct causes. Among the indirect causes hepatitis was responsible for 4 deaths, with two of them due to hepatitis E infection. Community acquired pneumonia was the next common cause. These underline the fact that neglect of early symptoms and signs makes treating physician pay a heavy price in terms of maternal mortality.

Of these maternal deaths, four patients had a Glasgow coma scale of 3 at admission and expired within few hours of admission reflecting a situation where patients were referred late in a moribund state. One mother expired after seemingly uneventful delivery, but deteriorated after massive post-partum hemorrhage stressing the fact that unexpected turn of events can occur in any low risk obstetric women and the importance of the Golden hour after delivery.



**Figure 1: Perinatal outcome in the critically ill obstetric patients.**

Out of sixteen patients who delivered beyond 28 weeks, three were born at live at term (>37 weeks) and one had term stillbirth. Remaining twelve patients had preterm delivery with five babies live at birth.

Two mothers were discharged undelivered, and delivered near term at a later date. Two patients had termination of pregnancy <28 weeks.

## DISCUSSION

The admission rates of an obstetric patient to ICU ranges from 2-9/1000 deliveries.<sup>1-4,7</sup> This correlated with our admission rates of 5.3/1000 deliveries. Obstetric patients are usually young and age is one of the prognostic factors. In our study, the mean age was 26.77 years with 48 (84%) patients between 19-30 years and only nine (16%) of the patients above 30 years. This was noted in studies by Rochat et al who found 72% of patients were between 21-30 years.<sup>8</sup>

Postpartum patients predominated comprising 54.38% (n=31) of the ICU admissions of Obstetric patients and antenatal patients were 45.62% (n=26). In a study by Bekele A et al. 31 (42%) were antenatal and 43 (58%) were postpartum.<sup>9</sup> Majority of the antenatal patients in our study were admitted in 3rd trimester while in their study, the mean gestational age was 29.2 weeks. Similar findings were noted in other studies.<sup>2,4</sup> These high postpartum admissions can be attributed to significant hemodynamic changes that occur soon after delivery with a 65% increase in cardiac output, acute blood loss at delivery and a decrease in plasma oncotic pressure.<sup>10</sup>

The need for mechanical ventilation and circulatory support were the main reasons for admission to ICU. In our study 55 out of 57 needed ventilator support (96%). In a study by Zeeman et al. 71% needed ventilator support.<sup>11</sup> The high incidence in our study is due to the fact that need for mechanical ventilation was the main reason to shift to ICU in our hospital. Obstetric causes predominated the reasons for admission to ICU. The common reasons amongst these were preeclampsia-related complications, hemorrhage and sepsis. Preeclampsia related complications included status eclampticus in two patients, one of them came with Mendelson's syndrome with poor oxygen saturation. Other complications were pulmonary edema, intracerebral hemorrhage, coagulation failure, renal failure and abruption. The common non-obstetric causes were pneumonia including two patients with swine flu. Four patients were admitted with hepatitis, two of these being hepatitis E. Aplastic anemia with severe thrombocytopenia leading to intracerebral bleeding was seen in one patient. Post elective cesarean under spinal anaesthesia at an outside hospital leading to meningitis was noted in one mother. Other studies from India,<sup>4</sup> Pakistan<sup>13</sup> have noted malaria, rheumatic heart disease, viral hepatitis, cerebral venous thrombosis as important reasons for ICU admissions.

MPM 2 (Mortality Probability Model) score<sup>5</sup> was used to calculate death predictability rate at the time of admission. Applying t-test, p value was <0.01 which is significant. Actual mortality (39.84%) was much higher than MPM2 predicted mortality (18.94%) indicating that MPM2 had under predicted our mortality. This was even noted in the study by Gupta, et al.<sup>2</sup> Though, in a retrospective records review by El-solh, et al. the predictive ability of APACHE II, SAPS II and MPM II scores in critically ill obstetric patients was evaluated and compared with critically ill non-obstetric female patients of similar age group and they noted that the observed mortality was similar in all three.<sup>13</sup>

Multiorgan failure (MOF) developed in 22 (38%) of our patients. The outcome of these patients depend on the number of organ involvement. MOF was noted in 10/16 (62%) of women who died. Respiratory, cardiovascular, renal and coagulation failure were common. This was also noted by Karnad et al.,<sup>3</sup> Daniela et al.<sup>14</sup>

During the hospital stay, sepsis was the next common complication in these patients during ICU stay. Tracheal cultures grew organisms ranging from *E. coli* to multidrug resistant *Acinetobacter baumannii*. Moreover sepsis in obstetric patients may be masked early in the process by the increased blood volume and is detected only when shock is uncompensated.<sup>15</sup> Anemia acts as a compounding factor as seen in 47% of our patients. Sepsis was the direct cause for maternal mortality in 3 (19%) of our patients.

The present study showed a maternal mortality of 28% (n=16) and the maternal mortality ratio (MMR) for the above said period was 148/1,00,000 live births. The MMR for India according to the latest Sample Registration Report of the Registrar-General of India estimate for 2010 to 2012 was 178/1,00,000 live births and for Tamil Nadu state was 97/1,00,000 live births.<sup>16</sup> The reason for this high MMR at our Institution being that it is a major referral centre in this part of Tamil Nadu. Hemorrhage, sepsis and preeclampsia continue to be the scourge of our mothers. According to an Indian Council of Medical Research study in 2003,<sup>17</sup> hemorrhage was responsible for 17% of the maternal deaths, septicemia in 13% of deaths, preeclampsia in 25% of deaths. In our study, 1/16 (6%) expired of severe preeclampsia leading to abruption placenta with DIC. Probably we were able to reduce deaths due to preeclampsia due to increased vigilance thereby preventing complications. But however perinatal mortality was very high with a rate of 50% (n=16) and premature births being 12(75%). This was comparable to the study by Bibi et al.<sup>18</sup>

## CONCLUSIONS

According to WHO systematic review of 2004,<sup>19</sup> transfer to ICU is taken as an indicator for assessing the prevalence of severe acute maternal morbidity. The most



common indication to transfer to our ICU was respiratory failure.

The preexisting health status of a woman plays a significant influence over the manner in which she can tide over complications of pregnancy apart from the antenatal care, intrapartum and postpartum care. Early assessment, referral and aggressive interventions by the team work of obstetricians, intensivists and anesthesiologists in a well equipped intensive care unit can bring about a change in the outcome of high risk pregnant women. Safe motherhood initiatives should be adopted at all levels to improve the overall health of our women.

## ACKNOWLEDGEMENTS

The authors are thankful to our colleagues, statistician, and staffs who helped us in this study.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee, PSGIMSR*

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DOI: 10.5455/2320-1770.ijrcog20140338

**Cite this article as:** Appinabhavi A, Panicker S, Rajkumar N. Maternal and perinatal outcomes in critically ill obstetric patients. *Int J Reprod Contracept Obstet Gynecol* 2014;3:189-94.