

A Study of Clinical Profile and Fetomaternal Outcome of Obstetric Patients Admitted to Intensive Care Unit: A Prospective Hospital-based Study

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ABSTRACT

Aims and objectives: To study clinical profile of obstetric patients admitted to intensive care unit (ICU) and to analyze the relation of demographic factors such as age, parity, literacy level, socioeconomic status, acute physiology and chronic health evaluation II (APACHE II) score, and level of delay with fetomaternal outcome.

Design: It is a prospective cross-sectional observational study.

Materials and methods: After admission to ICU a detailed history, analysis of basic demographic variables along with level of delay was done. APACHE II score was calculated. These parameters were correlated with fetomaternal outcome. The Chi-squared test was used to compare categorical variables. The one-way analysis of variance was used to compare the continuous variables among the strata with Tukey's *post hoc* test.

Results: Incidence of obstetric ICU admission was 0.77%. Mean age was 26.03 years. Most common indication of ICU admission was obstetrical hemorrhage (37.1%) followed by hypertensive disorders of pregnancy (25.8%). Type I delay was the most common followed by type II delay. Mean APACHE II score was 14.77 ± 6.85 . Observed mortality rate (30.6%) was found to be higher than predicted mortality rate (25%). APACHE II score was significantly high in the presence of level 1 ($p = 0.003$) and level 2 delays ($p = 0.0001$). Also, it was significantly increased with the duration of delays.

Conclusion: Unbooked and referred cases had high incidence of ICU admission. The presence of delay was associated with poor outcome.

Keywords: Delays, Fetomaternal outcome, Intensive care unit, Intensive care unit mortality, Intensive care, Obstetric, Pregnancy.

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INTRODUCTION

Maternal mortality is a grave injury to a family, community, and the entire nation. It remains unacceptably high with about 830 women dying from pregnancy or childbirth-related complications around the world every day [World Health Organization (WHO)]. Majority (99%) of all maternal deaths occur in developing countries. Between 1990 and 2015, maternal mortality worldwide dropped by about 44% from 385 to 216 maternal deaths per 100,000 live births. Despite this progress, the world still fell far short of the Millennium Development Goals target of a 75% reduction in the global maternal mortality rate (MMR) by 2015. Between 2016 and 2030, as part of the sustainable development goals, the target is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births.¹

It is of utmost importance that women at risk must be identified and managed appropriately. "Near miss maternal mortality" or "severe acute maternal morbidity" (SAMM) is more common than maternal mortality and is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days after termination of pregnancy".² The clinical and demographic profile of SAMM cases shares many characteristics with cases of maternal mortality;^{3,4} therefore, a clear comprehension and evaluation of patients diagnosed with SAMM will undoubtedly help to decrease and/or prevent maternal mortality.

To achieve optimal management of women with SAMM, principles of critical care management need to be applied.⁵ Critically ill obstetric patients present a challenge to the treating clinician because of the physiological changes of pregnancy and the presence of a fetus.^{5,6}

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The characteristics of these patients admitted to intensive care unit (ICU) including the sociodemographic factors are useful in better management of these patients in future. Also, the admission of the obstetric patient to ICU and their outcome is an indirect indicator of health care status of a country. There are three main factors that affect the outcome of such patients during pregnancy. These factors were defined, chronologically, as the lengths of the delays in: (i) the decision to seek care, (ii) reaching an appropriate medical facility, and (iii) the receipt of adequate and appropriate

treatment. Socioeconomic and cultural factors, accessibility of facilities, and quality of care may independently affect the lengths of these three delays.⁶

Recently, the report on "Strategies toward ending preventable maternal mortality" (EPMM Strategies), a direction-setting report outlining global targets and strategies for reducing maternal mortality in the Sustainable Development Goal period published by WHO in 2015 also reiterates the need to address the social, political, and economic determinants of maternal health and mortality.⁷

In this regard, the present study was designed to evaluate the factors responsible for ICU admission of obstetric patients, to analyze their clinical characteristics, to analyze the associated levels of delay, and to correlate these with the fetomaternal outcome.

MATERIALS AND METHODS

This was a prospective observational hospital-based study which was conducted in 10 bedded ICU at Deen Dayal Upadhyay Hospital, Hari Nagar, Delhi. About 124 obstetric patients admitted to ICU during pregnancy, delivery or within 42 days postpartum, from July 2017 to December 2018 were included in the study.

After admission to ICU, a detailed history was taken from relatives of the patient and also extracted from available medical records.

Basic demographic variables (age, parity, literacy level, socioeconomic status) of the patient were recorded. Acute physiology and chronic health evaluation (APACHE II) of each patient was calculated within 24 hours of ICU admission.

Clinical data regarding diagnosis at the time of hospital admission, indication for ICU admission, mode of delivery, length of ICU stay and hospital stay, interventions if any, treatment administered, and maternal and perinatal outcome were collected.

Outcome Measure

- Maternal survival
- Length of ICU stay
- Total length of hospital stays
- Perinatal morbidity [neonatal ICU (NICU) admission, low APGAR score]
- Perinatal mortality

The patients were followed up till discharge or death.

Statistical Analysis

The results are presented in frequencies, percentages, and mean \pm standard deviation. The Chi-squared test was used to compare categorical variables. The one-way analysis of variance was used to compare the continuous variables among the strata with Tukey's *post hoc* test. The *p* value < 0.05 was considered significant. All the analyzes were carried out on SPSS 16.0 version (Chicago, Inc., USA).

RESULTS

- The incidence of ICU admission was 0.77% (124 ICU admission/15,982 total obstetric admission).
- Majority of patients were between 20 years and 30 years (80.6%). Age was not associated with outcome ($p > 0.05$)
- About 53.2% cases were unbooked and 55.6% patients were referred from peripheral hospitals. All the outcomes were significantly worse in referred patients except perinatal morbidity.

- More than one-third of the patients were uneducated (39.5%) followed by below high school (30.6%), high school intermediate (21.8%), and graduate (8.1%). The maternal mortality, perinatal mortality, and prolonged ICU stay were higher in the uneducated patients. More than half of the patient belonged to lower class (66.9%) followed by upper lower (29%) and lower middle (4%) classes. All the outcomes were worst in patients of lower socioeconomic strata. However, no significant ($p > 0.05$) association could be established.
- About 67.7% of patients were multiparous. There was no significant association found between parity and the outcomes.
- Admission to ICU was more common in postpartum period (88.7%) when compared with antenatal period (11.3%).
- There was no delay present at any level in 25% cases. About 75% of patients had delay at single or multiple levels. Presence of delay was significantly associated with prolonged ICU stay ($p = 0.001$), maternal mortality ($p = 0.003$), and perinatal mortality ($p = 0.01$). The association of outcomes with presence or absence of delay and duration of delays is depicted in Tables 1 and 2, and Figure 1.
- First level delay was present in 34.7% cases. Second level delay was present in 50% cases and it was more than 4 hours in 16.9% patients. Third level delay was present in 9.7% patients.
- Presence of first and second level delays and their increasing duration was significantly associated with prolonged ICU stay ($p = 0.002$ and $p = 0.01$, respectively), maternal mortality ($p = 0.001$ and $p = 0.004$, respectively), and perinatal mortality ($p = 0.002$ and $p = 0.005$, respectively).
- APACHE II score of 5–9 was most common (28.2%) and APACHE II score of < 4 was present only in 0.8% cases. Mean APACHE II score was 14.77 ± 6.85 . Tables 3 and 4 depict the comparison of APACHE II score with delays and its association with outcomes.
- The *post hoc* test revealed that APACHE II score was significantly ($p < 0.05$) high in patients having delay of ≥ 24 hours. APACHE II score was significantly higher in the presence of second level delay and it significantly increased as the duration of delay increased ($p = 0.0001$).
- High APACHE II score was significantly associated with length of ICU stay ($p = 0.001$), maternal mortality ($p = 0.001$), perinatal mortality ($p = 0.001$), and length of hospital stay ($p = 0.008$).
- Most common indication for ICU admission was obstetrical hemorrhage (37.1%) followed by hypertensive disorders of pregnancy (25.8%).
- Blood and blood product transfusion (83.87%), mechanical ventilation (66.12%), and the use of inotropic support (47.58%) were the major interventions done. Surgical intervention was done in 25% cases in association with other major interventions. Maternal mortality was decreased in patients who had timely surgical intervention though no significant association was found.
- Mean length of ICU stay was 3.18 ± 2.40 .
- Most common mode of delivery was cesarean section (58.1%).
- Thirty-eight (30.6%) patients could not be saved.
- Thirty (29.12%) neonates had low APGAR score and needed NICU admission. Thirteen (12.62%) patients had intrauterine death of the fetus and another eight (7.76%) had early neonatal death in NICU. Five (4.85%) patients had still birth. Perinatal morbidity was seen in 29.12% subjects and perinatal mortality rate was 31.06%.
- The length of hospital stay was ≤ 7 days in 58.9% patients. Mean length was 7.09 ± 3.49 days.

Table 1: Association of outcomes with presence or absence of delay and single or multiple delay

Delay	No. women	Length of ICU stay >48 hours		Maternal mortality		Perinatal morbidity		Perinatal mortality		Hospital stay >7 days	
		No.	%	No.	%	No.	%	No.	%	No.	%
Any of three delays											
Yes	93	56	60.2	35	37.6	20	21.5	29	31.2	39	41.9
No	31	8	25.8	3	9.7	10	32.3	3	9.7	12	38.7
<i>p</i> value ¹		0.001*		0.003*		0.22		0.01*		0.75	
Type of delay											
Single	36	20	55.6	11	30.6	7	19.4	7	19.4	13	36.1
Multiple	57	36	63.2	24	42.1	13	22.8	22	38.6	26	45.6
<i>p</i> value ¹		0.46		0.26		0.70		0.05		0.36	

¹Chi-squared test. *Significant; ICU, intensive care unit

DISCUSSION

In the present study, which was done over a period of 18 months, incidence of ICU admission was 0.77% which is comparable to the results of Begum and Padmavati.⁸ However, Ozumba et al.⁹ in 2018 in their study found a higher incidence of 1.7% probably due to different admission criteria or due to a large catchment area.

It is obvious that booked status of the patients is associated with better outcome as is also reflected in the present study. In contrast to the present study, Joseph et al.¹⁰ found increased ICU admission among booked cases. Probably this was due to the referral of these booked cases in complicated stages.¹⁰

In the present study, referred cases comprised the major part (55.6%) of the ICU admissions and their outcomes were significantly worse than the direct admissions.

This may be attributed to the fact that the patients who are referred are generally high risk or in critical condition as they could not be managed at the periphery hospital. If this factor is also associated with delay in the transport then the outcome of the referred patients further deteriorates.

Maternal health behavior varies with socioeconomic status and it is also affected by education level. Low socioeconomic status is usually associated with low education status, poor health seeking behavior, unintended, unplanned pregnancy, and inadequate antenatal visits. These issues are clubbed with logistic problems such as inaccessibility to health care and form a vicious circle in this strata. The same is clearly reflected in the present study where patients of lower socioeconomic strata had worse outcomes. Concordant results were found by the Panda et al., 64.13% of the patients admitted to ICU in their study belonged to lower socioeconomic status.¹¹

To improve the medical care in obstetric emergency, time is a crucial factor in life-threatening conditions. Delay at any level worsens the prognosis of patients because life-threatening conditions may develop without any warning and require prompt treatment.

In the present study, first level delay was present in 65.4% cases admitted in ICU.

Similar to the present study, Ghumare et al. found that 27% delays were at the first level. In 19% cases, mixed delay was present.¹² Kumari et al. also observed that first delay was present in 81.8% of cases and level 1 delay was the most common delay found.¹³

In the present study, most common delay found was the delay at level 1, which is the delay in deciding to seek care. It was mainly due to socioeconomic and cultural characteristics. They were also not educated about the warning sign of any complication by the front-line provider [i.e., accredited social health activist (ASHA)] in some cases. An ASHA is a community health worker instituted by the government of India's Ministry of Health and Family Welfare (MoHFW) as a part of the National Rural Health Mission (NRHM). Their antenatal visits were limited to nutritional supplements and a general check up at the ground level which might have missed preexisting medical and also obstetrical complications such as malpresentation and cephalopelvic disproportion.

The hesitation to seek health care was compounded by cultural taboos and gender bias which further increased the duration of delay. The outcomes worsened significantly with increasing duration of level 1 delay. This again emphasizes the importance of intervention in the first few golden hours.

Table 2: Association of outcomes with different level of delay and their duration

Delay	No. women	Length of ICU stay > 48 hours		Maternal mortality		Perinatal morbidity		Perinatal mortality		Hospital stay > 7 days	
		No.	%	No.	%	No.	%	No.	%	No.	%
1st level											
No delay	43	14	32.6	6	14.0	12	27.9	6	14.0	18	41.9
<24 hours delay	39	20	51.3	10	25.6	7	17.9	7	17.9	14	35.9
≥24 hours delay	42	30	71.4	22	52.4	11	26.2	19	45.2	19	45.2
<i>p</i> value ¹		0.002*		0.001*		0.53		0.002*		0.69	
2nd level											
No delay	62	24	38.7	11	17.7	16	25.8	8	12.9	21	33.9
≤4 hours delay	41	25	61.0	16	39.0	10	24.4	16	39.0	19	46.3
>4 hours delay	21	15	71.4	11	52.4	4	19.0	8	38.1	11	52.4
<i>p</i> value ¹		0.01*		0.004*		0.82		0.005*		0.23	
3rd level delay											
No delay	112	59	52.7	36	32.1	28	25.0	28	25.0	45	40.2
<6 hours delay	12	5	41.7	2	16.7	2	16.7	4	33.3	6	50.0
>6 hours delay	0	0		0		0		0		0	
<i>p</i> value ¹		0.46		0.26		0.52		0.53		0.51	

¹Chi-squared test. *Significant; ICU, intensive care unit

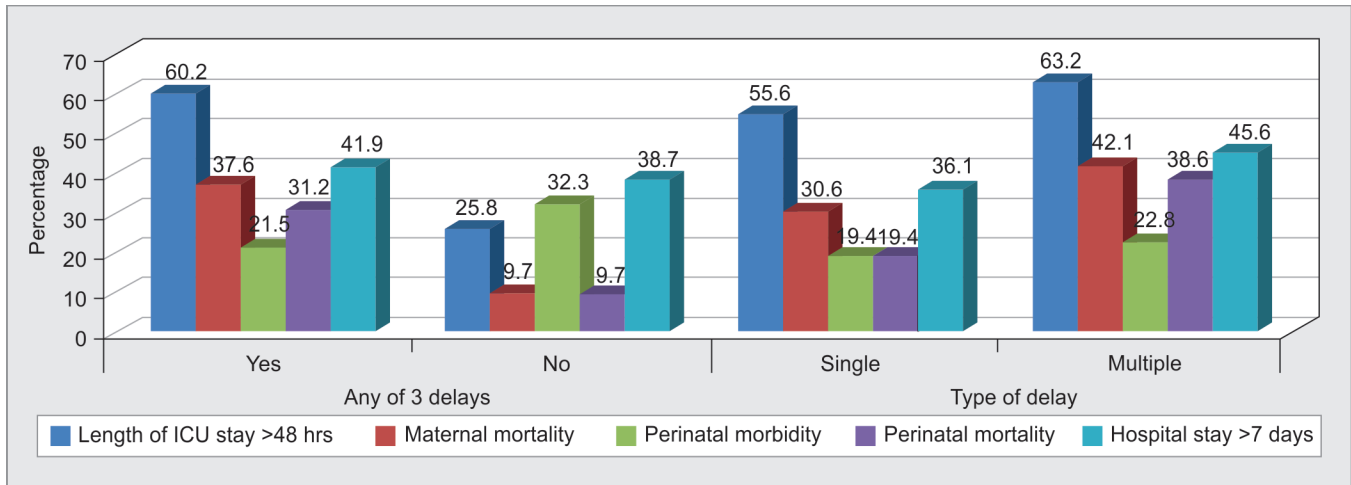


Fig. 1: Association of outcomes with presence or absence of delay and single or multiple delay. ICU, intensive care unit

Table 3: Comparison of acute physiology and chronic health evaluation II (APACHE II) score with delay

Delay	APACHE II score	p value ¹
1st level		
No delay	11.95 ± 5.66 ^{a,b}	0.003*
<24 hours delay	15.77 ± 7.36 ^a	
≥24 hours delay	16.74 ± 6.67 ^b	
2nd level		
No delay	12.60 ± 6.33 ^{a,b}	0.0001*
≤4 hours delay	15.85 ± 6.21 ^a	
>4 hours delay	19.10 ± 7.25 ^b	
3rd level delay		
No delay	14.86 ± 7.00	0.68
<6 hours delay	14.00 ± 5.47	

¹ANOVA test. *Significant. ^{a,b}p < 0.05 (post hoc tests)

Second level delay is the delay in reaching the appropriate health care facility and in the present study, it was present in 50% cases.

Similar to our study, Kumari et al. also found that contribution of second level delay was present in 54.5% cases.¹³

Second level delay of <4 hours is present in 33.1% which was mainly due to geographic distribution of referral center, cost of transportation, and unavailability of transport. Second level delay of >4 hours was found in 16.9% and was associated with delayed decision of referral by peripheral hospital. Main reasons of referral were nonavailability of NICU, blood bank, ICU facility, and facility of cesarean section (lack of functional operation theater or trained personnel). This results in lack of active intervention in the first few golden hours thus worsening the condition of the patients.

Third level delay was present in 9.7% cases in the present study. Presence of third level delay in our tertiary care hospital could probably be explained by disproportionate infrastructural facility in comparison with the patient load (only single functional emergency operation theater, no availability of dedicated obstetric ICU facility, a smaller number of beds available in general ICU).

In contrast to present study, Ghumare et al. found that third level delay was present in 21% cases¹² and Kumari et al. also found third level delay in 45.5% cases.¹³ It was higher than the present study which may have been contributed by superadded effect of

inadequate specialist services and inadequate blood component transfusion facility.^{12,13}

The presence of any delay was significantly associated with worse outcomes. In a multicentric cross-sectional study done by Pacagnella et al., any type of delay was observed in 53.8% of subjects, and there was positive association between the presence of any delay and severity of maternal outcome.¹⁴ Kumari et al. observed that most of the deaths were associated with multiple levels of delay.¹³

It was observed that the most common indication for ICU admission was obstetrical hemorrhage (37.1%), followed by hypertensive disorder of pregnancy (25.8%). In concordance with the present study, Sodhi et al.¹⁵ and Joseph et al.¹⁰ had similar results but Ozumba et al.⁹ found that rupture uterus was the most common indication of ICU admission. Uterine rupture has been remarkably eliminated in most parts of the world but probably low socioeconomic status and poor health-seeking behavior of the subjects in the study (South East Nigeria) contributed to this finding.⁹

The mean APACHE II score was 14.77 ± 6.85. According to this predicted mortality was 25% but observed mortality was found to be higher, that is, 30.6%. This was probably due to the infrastructure and logistic constraints of our study area which is a government organization. There was significant (p < 0.01) difference in APACHE II score in the presence of first and second level delay. APACHE II score was significantly (p < 0.05) high in patients having delay of ≥24 hours. Also, APACHE II score was significantly higher in the presence of second level delay and it was significantly increased as the duration of delay increased (p = 0.0001).

In contrast to the present study, Sodhi et al. found observed mortality rate to be too low when compared with the predicted mortality of 24%.¹⁵ This variability can probably be explained as this study was conducted in a private hospital having most of the modern equipment. Our study was conducted in a government setup having limited and conventional resources.

RECOMMENDATION AND CONCLUSION

- The results clearly reflect that presence of delay and its increasing duration play a vital role in increasing maternal and perinatal mortality. This implies that social and health initiatives taken to decrease duration of level 1 delay will go a long way in decreasing maternal morbidity and mortality.

Table 4: Association of outcomes with APACHE II score

Interventions	Length of ICU stay > 48 hours		Maternal mortality		Perinatal morbidity		Perinatal mortality		Hospital stay > 7 days	
	No.	%	No.	%	No.	%	No.	%	No.	%
<4	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5-9	35	14.3	3	8.6	5	14.3	5	14.3	9	25.7
10-14	34	64.7	2	5.9	15	44.1	3	8.8	22	64.7
15-19	25	76.0	7	28.0	4	16.0	8	32.0	12	48.0
20-24	18	61.1	16	88.9	4	22.2	12	66.7	4	22.2
25-29	5	80.0	4	80.0	1	20.0	1	20.0	3	60.0
30-34	6	50.0	6	100.0	1	16.7	3	50.0	1	16.7
p value ¹		0.001*		0.001*		0.09		0.001*		0.008*

¹Chi-squared test. *Significant. APACHE II, acute physiology and chronic health evaluation II; ICU, intensive care unit

- It was also evident by results that patients who had timely surgical intervention had less maternal and perinatal mortality. So, at tertiary care level, improvements should be done to bridge the gap between infrastructural facilities and the growing demands by building dedicated obstetric ICU, recruiting more trained staff and developing obstetric corridor in every tertiary care hospital to reduce the delay.

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