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Original Article

Study of Critical Illness in Pregnancy

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Abstract

Background: Critical care is bonafide part of obstetric practice. A critically ill obstetric patient is one, who, because of normal or abnormal pregnancy, delivery, and puerperium or because of effects of systemic disease develops complications threatening her life for which she needs intensive monitoring, therapy or life support system. In view of this, the present study makes an attempt to study these disorders threatening the lives of both mother and the child, recognizing the various risk factors associated in a given scenario so as to have a high index of suspicion and their outcome in a given setup. Once established, early prevention of these risk factors and effective treatment of these complications can have dramatic impact on the maternal mortality.

Methods: The present study entitled "study of critical illness in pregnancy" was carried out in the Medical Intensive Care Unit (MICU) of Dr. D.Y. Patil Hospital and Research Center, Nerul, Navi Mumbai, Maharashtra, India, with participants being all pregnant and postpartum females (up to 42 days after delivery) transferred to intensive care unit for period of 2 years (2013-2014).

Results: Majority of patients requiring MICU admissions were in age group between 21 and 25 years. The mortality rate was significantly higher in age group of ≤20 years and majority of pregnant females were Primigravida.

Conclusion: Maternal age <20 years is associated with significantly high mortality in critically ill obstetric population (40%). Thus younger age and not the ideal reproductive age is a high risk group. In third world countries (medical/infective) indirect obstetric (52.4%) cause are more rampant for mortality. The most common medical complications requiring critical care were infective causes such as malaria, viral hepatitis, and sepsis. Pregnancy induced hypertension was most common indication for MICU care followed by malaria though mortality was highest by malaria and respiratory failure was most common organ system failure (51.3%) seen in our study.

Key words: Critical illness, Obstetric patients, Pre-eclampsia

INTRODUCTION

Critical care is bonafide part of obstetric practice. A critically ill obstetric patient is one, who, because of normal or abnormal pregnancy, delivery, and puerperium or because of effects of systemic disease develops complications threatening her life for which she needs intensive monitoring, therapy or life support system. In India, one woman dies every 5 min from a pregnancy-related cause.[1] It is estimated that 15% of deaths of women in reproductive age in India are maternal deaths. Following table shows difference in maternal mortality rate between developing countries like India and developed countries (Table 1). India has a maternal mortality rate of 450 deaths per 100,000 live births.[2]

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The main reasons behind high maternal mortality in India are:

1. Deliveries not attended by trained personnel: National Family Health survey (NFHS-2) (the NFHS, conducted in 1998) reports that only one-third (34%) of deliveries in India take place in health-care facilities and two-fifth (42%) of deliveries are unattended by a trained medical professional.
2. Women not seeking antenatal care; more than 1 out of 3 women (34%) in India did not receive an antenatal check-up for births in the 3 years preceding the survey. Only 7% received antenatal check-up in third trimester.
3. Postnatal care is grossly deficient.

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Table 1: MMR among different countries

Country	MMR (maternal deaths per l00,000 live births)
India	450
Canada	7
United Kingdom	8
Germany	4
United States of America	11

MMR: Maternal mortality rate

Thus, it is imperative to study the various medical complications contributing to the maternal mortality. In view of this, the present study makes an attempt to study these disorders threatening the lives of both mother and the child, recognizing the various risk factors associated in a given scenario so as to have a high index of suspicion and their outcome in a given setup. Once established, early prevention of these risk factors and effective treatment of these complications can have dramatic impact on the maternal mortality.

METHODS

Study Design

It is a prospective observational study.

Setting

This study was conducted in the Medical Intensive Care Unit (MICU) of a tertiary care teaching hospital.

Participants

All pregnant and postpartum females (up to 42 days after delivery) transferred to intensive care unit for period of 2 years.

All the routine investigations done in MICU patients were taken into consideration. This included withdrawing around 20cc of blood on day of admission or within 24 h of admission in MICU and on the day of discharge from MICU. Furthermore, urine sample and required culture samples were taken.

Interventions

All the patients were given routine MICU care appropriate for the disease condition. Appropriate antibiotics according to prevalent sensitivity patterns and specific culture sensitivity reports were given.

Supportive therapy was given to these patients as follows:

- Central venous line insertion - in hypotension, cardiac failure, etc.
- Endotracheal intubation - as a prophylactic measure in unconscious patients or those requiring artificial respiration.
- Ventilatory support - in respiratory distress or failure.
- Nutrition was maintained with IV fluids and Ryle's tube feeding in drowsy or unconscious patients and oral feeding in conscious patients.
- Severe anemia was treated with packed cell transfusion.
- DIC with fresh frozen plasma and blood ± platelets.
- Renal failure with hemodialysis or conservative management.
- Hypoglycemia with dextrose infusions.
- Metabolic acidosis with sodium bicarbonate administration or dialysis.

All the treatment was at the discretion of the ICU physicians. The treatment strategy was individualized for each patient and was the sole prerogative of the treating physician outcome: Outcome of each patient was classified as either survived or expired. Data thus obtained were tabulated and statistically analyzed, using Pearson Chi-square test with the help of SPSS version 18.

RESULTS

Majority of patients requiring MICU admissions were in age group between 21 and 25 years. This group contributed almost 42.31% of obstetric admission in MICU (Table 2).

The mortality rate was significantly higher in age group of ≤20 years. The Pearson Chi-square test $P = 0.045$ which is significant.

Majority of females died who were admitted in their third trimester.

Mortality rate was highest in third-trimester antepartum period 22.7%.

The Pearson Chi-square test $P = 0.771$ which is not statistically significant.

Following table shows different indications for which pregnant females were transferred to MICU (Table 3).

Majority of the patients required MICU care due to eclampsia and pre-eclampsia 36.5%, 19 patients out of 52.

Malaria was most common cause of death, 30%, 3 patients out of 10 who died (Table 4).

High mortality was observed during 6-10 days of MICU stay.

The Pearson Chi-square test $P = 0.522$ which is not statistically significant.

Table 2: Correlation of age with mortality

Age	Died	Died%	Survived	Survived%
≤20	2	40	3	60
21-25	7	31.82	15	68.18
26-30	0	0	18	100
>30	1	14.29	6	85.71
Total number	10	19.2	42	80.76

Table 3: Indications for MICU care in pregnant and postpartum females

Diagnosis	Count (%)
Eclampsia/pre-eclampsia	19 (36.5)
Malaria	12 (23.1)
Sepsis	8 (15.4)
DIC	4 (7.7)
RHO	3 (5.8)
OBS-HMG	3 (5.8)
HEP	3 (5.8)
Anemia	2 (3.8)
Ectopic	2 (3.8)
Dengue	2 (3.8)
Viral atypical pneumonia	1 (1.9)
GTC	1 (1.9)
H1N1	1 (1.9)
GDM	1 (1.9)
COPD	1 (1.9)

Table 4: Correlation of duration of MICU stay with mortality

Days	Died	Survived	Died%	Survived%
1-5	7	33	17.5	82.5
6-10	3	7	30	70
>10	0	2	0	100

Majority of the patients who died in MICU care had hemoglobin levels of 6-8 g/dl.

The Pearson Chi-square test $P = 0.163$ which is statistically significant (Table 5).

Majority of the patients who died in MICU care had a platelet count of <60000.

The Pearson Chi-square test $P = 0.447$ which is statistically significant (Table 6).

High bilirubin levels 6-lOmg/dl were associated with significantly high mortality.

The Pearson Chi-square test $P = 0.412$ which is statistically significant (Table 7).

High APACHE II score> 34 on admission was associated with significantly high mortality 100%.

Table 5: Correlation of platelet count with mortality

Platelets	Dead	Alive	Dead%	Alive%
<60	3	7	30	70
60-120	4	11	26.67	73.33
120-180	1	12	7.69	92.31
180-240	1	3	25	75
240-300	0	4	0	100
≥300	1	5	16.67	83.33

Table 6: Correlation of bilirubin levels with mortality

Bilirubin	Died	Survived	Died%	Survived%
<1	5	26	16.1	83.9
l-5	3	13	18.8	81.3
6-10	2	2	50	50
≥10	0	1	0	100

Table 7: APACHE II score on admission and comparison of observed and predicted mortality

APACHE II score	Total patients	Died	Observed mortality (%)	Predicted mortality
0-4	14	0	0	4
05-09	8	0	0	8.00
10-14	8	0	0	15
15-19	5	0	0	25
20-24	7	3	42.85	40
25-29	4	2	50	55
30-34	5	4	80.00	75
>34	1	1	100.00	85

The Pearson Chi-square test $P = 0.033$ which is statistically significant.

DISCUSSION

Our hospital being tertiary referral center, many patients are transferred from private nursing homes and other hospitals. With rising awareness in medical care, more and more patients can be salvaged, only if these references are made early and with some of the necessary resuscitative measures.

Present study which spanned a period of 2 and a half years aimed at studying the clinical profile of obstetric patients admitted to Medical Critical Care Unit. This included an evaluation of age, parity, gestational age, and primary diagnosis at time of MICU admission. Data regarding the number of days of stay in MICU the number of days on mechanical ventilation, the number and type of invasive procedures performed were collected and tabulated. The severity of condition and its prognosis assessed with APACHE II score system and the number of organs involved at the time of admission. The inferences that

were made from our study were then compared to those from other relevant studies.

Total number of obstetric admissions in critical care unit is a vital indicator to incidence of life-threatening complications in pregnant mother.

The data from various studies show variable results of MICU admission statistics (Table 8).

The mean distribution of age in various other studies is tabulated (Table 9).

These studies thus show that majority of obstetric patients requiring critical care are in age group 21-30 years which is comparable to our study.

Two other studies by Bhattacharya *et al.*[7] and Patel *et al.*[8] also showed the maternal mortality comparable to our study (27.5%) in the age group of 21-30 years. Mortality in age group of <20 years in our study was 40% whereas these studies[8,9] showed a mortality ranging from 1.7 to 11.9% in above age group. Mortality rate was 14.29% in females more than 30 years of age. Thus, the above results indicate that younger age group has higher chances of adverse outcome in critically ill obstetric patients.

In our study, majority 52.4% of patients were admitted with pregnancy or delivery related complications (direct causes), the most common being pregnancy induced hypertension (PIH) (36.5%), followed by puerperal sepsis (15.4%).

The rest of the patients (47.6%) were admitted with causes that medical (infectious) illness aggravated in pregnancy (indirect causes) most common being malaria (23.1%). Since Navi Mumbai is a malaria endemic zone, the second highest cause being malaria is explained.

Table 8: MICU admission statistics

Authors	Obstetric admission rate (%)
Mabie *et al*. (1990)[3]	0.90
Lewinsohn *et al*. (1994)[4]	3.40
Present study	6.40

Table 9: Distribution of age in MICU

Authors	Age group (years)	Total numbers (%)
Patkar *et al*. (1996)[5]	21-30	56
	>30	14.7
Rochat *et al*. (1988)[6]	21-30	72
	>30	11
Present study	21-30	76.92
	>30	13.46
	<20	9.62

It has been shown in other studies that hypertension in pregnancy is one of the most common indications requiring MICU care:

- Study in Netherlands by Zeeman CG, Obstetric critical care: A blueprint for improved outcome.[9]
- Study in France by Bouvier-Colle MH, Eur J Obstet Gynecol Reprod Biol. 1996 Mar; 65(1):121-5.[10]
- Study at Parkland hospital ICU, 40% admissions were due to hypertensive disorders and in various studies,[11-14] which is comparable to our study.

MMR in our study was 19.23% (10 patients out of 52).

Direct maternal mortality was 30%. Indirect maternal mortality was 70%.

The most common (pregnancy-related cause) direct cause of mortality in our study press syndrome and eclampsia (20% of total mortality). The most common (medical/infective) indirect cause of mortality was malaria (30% of total mortality).

Prevalence of anemia was 75% in the malaria patients which can be attributed to the parasitemia causing hemolysis.

PIH was another significant complication present in 41.7% of the malaria patients in our study.

The correlation between malaria and PIH as complication is further supported following studies to which our results are comparable (Table 10).

Following table shows mortality with hypertensive disorders of pregnancy reported by some authors (Table 11).

Table 10: Correlation between malaria and PIH as complication

Authors	Total numbers (%)
Adam *et al*., Central Sudan 2011, Malaria Journal Volume 10[15]	80.4
At is Muehlenbach's *et al*. 2006 PLOS medicine, www.Piosmedicine.org[16]	59
Pearson, PLoS Med. 2007 March;[17]	63.7

Table 11: Mortality with hypertensive diorders of pregnancy

Authors	Mortality in Micu due to pre-eclampsia/eclampsia (%)
Baskett *et al*. (1998)[11]	33
Rochat *et al*. (1988)[7]	14.8
Pritchard *et al*. (1984)[18]	0.4
Sibai *et al*. (1990)[19]	10
Bhagwanjee *et al*. (2000)[20]	10.8
Present study	20

Figures 1 and 2 show age distribution among cases in MICU and gestational age correlation with mortality in pregnant and postpartum patients respectively. Mortality due to PIH in our study is comparable to studies by Sibai, Rochat, and Bhagwanjee. Patients died due to PIH alone (10%), and the other due to press + gestational diabetes mellitus (10%). Still making infective causes a more significant factor for mortality.

Few studies[7,11] reported the mortality of 27% due to sepsis and 18% due to obstetric hemorrhages. As seen in Figure 3 malaria accounts for highest mortality (30%). In our study, we found 20% of mortality in critically ill obstetric patients due to sepsis which is comparable with the above studies. The most common causes for sepsis were lower respiratory tract infections, puerperal sepsis. There was no mortality due to obstetric hemorrhage in our study as against high mortality reported in various other studies.[7,11,21] Figure 4 shows low haemoglobin to be responsible for increased mortality whereas Figure 5 depicts mortality due to direct and indirect causes.

Only one patient was admitted due to H1N1 who died in the next 5 days. The patient had received Oseltamivir on the 2nd day. The patient developed acute respiratory distress syndrome (ARDS) and required ventilatory support. But she succumbed to the infection.

The most common organ failure seen in our patients was respiratory failure (51.3%) comparable to the respiratory failure seen in studies by Collop NA 1993[22] second was cardiovascular (43.6%) failure. Figure 6 shows anemia as a major complication of malaria.

Third was hematological (41%) failure. (The percentages do not add up to 100% as patients simultaneously had more than one organ failure).

The high percentage of respiratory failure can be attributed to ARDS due to malaria H1N1, viral pneumonia, and sepsis. (Malarial ARDS being responsible for 30% of mortality).

The need for mechanical ventilation and various invasive procedures was also evaluated in this study 29.3% of total patients required support of artificial mechanical ventilation. ARDS, cardiogenic pulmonary edema, neurological involvement, and circulatory shock were among major causes of respiratory failure requiring artificial ventilatory support. Figure 7 shows most common organ failure is respiratory failure and Figure

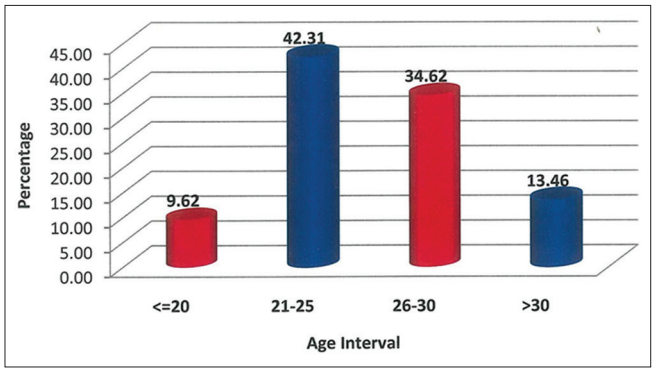

Figure 1: Age distribution among the cases

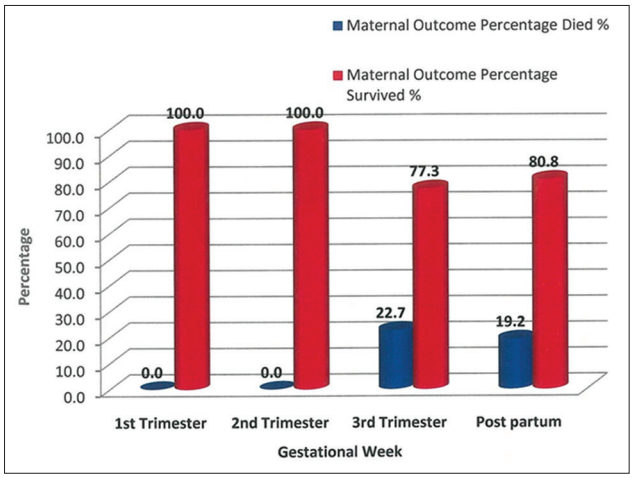

Figure 2: Gestational age correlation with mortality

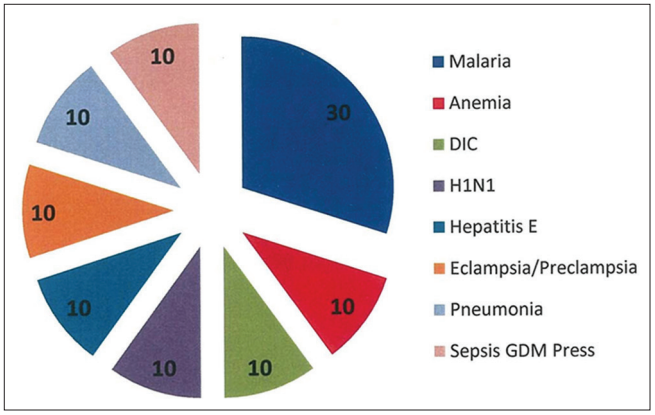

Figure 3: Mortality in pregnant and postpartum patients

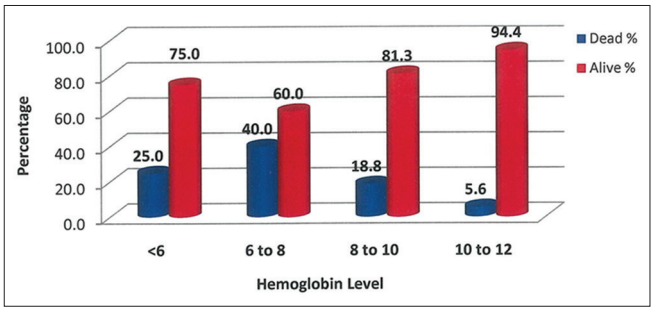

Figure 4: Correlation of hemoglobin levels with mortality

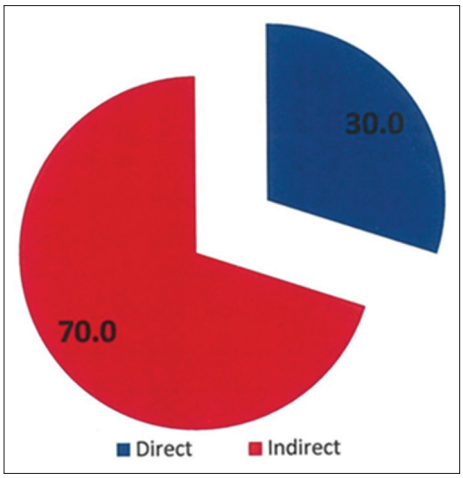

Figure 5: Mortality in pregnant and postpartum females

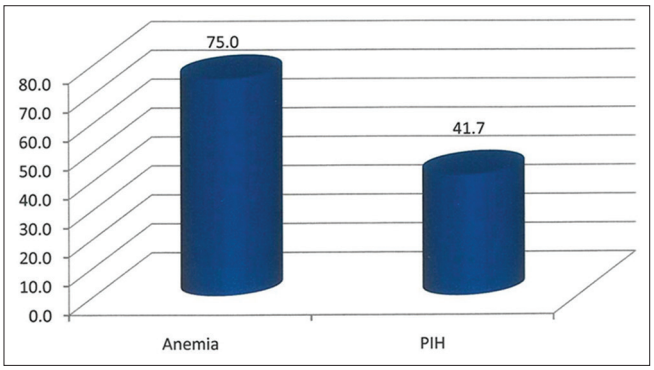

Figure 6: Malaria complication

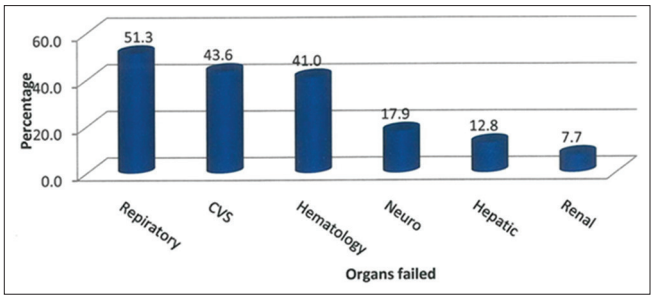

Figure 7: Organs failed

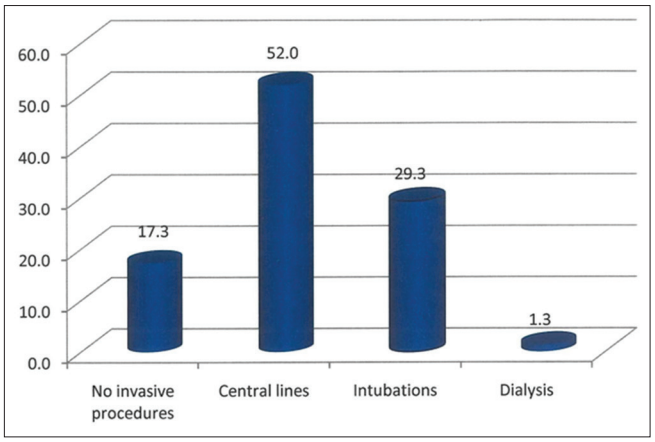

Figure 8: Invasive procedures

8 shows the various invasive procedures done in such patients.

Bekele *et al.* (2001) showed that 45% of critically ill obstetric patients required mechanical ventilation. In this study, the most common organ failure was respiratory failure and 15% of total patients developed ARDS.[13] Tang *et al.* and Lapinsky *et al.* (1997) in their studies showed that mechanical ventilation required in 12-55% of obstetric patients admitted to intensive care unit.[23,24] Which is comparable to our study (29.3%).

One of the aim of our study was to calculate APACHE II score of all obstetric patients on admission and to determine whether it can used as a tool to predict mortality in critically ill obstetrics patients.

Described in 1985 by Knaus,[25] the APACHE II prognostic system is one of the most widely used general outcome models. Developed for use with unselected groups of critically ill adults, the system uses three types of data to provide the user with a probability of death at hospital discharge: These data are the acute physiology score, based on the most deranged physiological and laboratory values during the first 24 h in the ICU; the premorbid status, based on a list of chronic diseases and conditions apparent at admission to hospital; and the diagnostic category, based on a list of 29 medical and 24 surgical diagnoses. After the initial score has been determined within 24 h of admission, no new score can be calculated during the hospital stay. If a patient is discharged from the ICU and readmitted, a new APACHE II score can be calculated. An increasing score (range 0-71) was closely correlated with the subsequent risk of hospital death for 5815 intensive care admissions from 13 hospitals. This relationship was also found for many common diseases. When APACHE II scores are combined with an accurate description of disease, they can prognostically stratify acutely ill patients and assist investigators comparing the success of new or differing forms of therapy. This scoring index can be used to evaluate the use of hospital resources and compare the efficacy of intensive care in different hospitals or over time.

In our study, we found that as APACHE II score increases mortality also increases significantly. Furthermore, we found that observed mortality in our study was comparable to predicted mortality ascertaining the fact that APACHE II scoring system is good predictor of mortality in critically ill obstetric patients and can be used as effective tool to

determine outcome and accordingly modify treatment strategy in these patients. Overall, predicted deaths in our study were 17 while observed deaths were 10 giving a standardized mortality ratio (predicted deaths/observed deaths) of 1.7 as against ratio of 0.78 in the study by.[14] Thus from our study, we conclude that APACHE II score is good predictor of mortality in critically ill obstetric patients.

CONCLUSION

Thus in our study of 52 critically ill pregnant and postpartum females in MICU we conclude that:

1. Maternal age <20 years is associated with significantly high mortality in critically ill obstetric population (40%). Thus, younger age and not the ideal reproductive age is a high-risk group.
2. In third world countries (medical/infective) indirect obstetric (52.4%) cause are more rampant for mortality. The most common medical complications requiring critical care were infective causes such as malaria, viral hepatitis, and sepsis.
3. PIH was most common indication for MICU care followed by malaria. However, PIH was not responsible for higher mortality though it was responsible for higher fetal mortality and longer maternal and fetal ICU stay.
4. Malaria was responsible for highest mortality (30%).
5. Malaria was associated with malaria-induced hypertension and anemia as complication.
6. Mortality rate in our study was 19.23%. (Which is total number of patients died from total number of MICU admissions) (10 out of 52).
7. Respiratory failure was most common organ system failure (51.3%) seen in our study.
8. Mortality was high in first 5 days of MICU admission (76.92%). Highlighting importance of close supervision during this period. *6-10 days were (19.23%) and >10 days (3.82%).
9. High bilirubin levels (levels more than 5 mg/dl) on admission were associated with significantly high mortality. (50% mortality). **>1 mg/dl of bilirubin (16.13%) mortality and 1-5 mg/dl bilirubin (18.75%) mortality.
10. High APACHE II score on admission was associated with significantly high mortality and APACHE II score predicts mortality well in critically ill obstetric patients. Thus, it can be used as tool to predict mortality in this population.
11. H1N1 infection in pregnancy is associated with high rate of complications and prompt treatment with Oseltamivir is associated with good maternal and fetal outcomes.
12. Thus medical disorders should be treated in the antenatal period itself by the appropriate specialties. Early recognition of the patient going downhill before one or multiple systems start failing is important as is the importance of good intensive care once this does occur.
13. Finally a short period of training in the MICU for all residents of obstetrics and gynecology should be mandatory. Lifesaving procedures would be useful when managing these patients till MICU bed is obtained.

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