

Intensive care management and outcome of women with hypertensive diseases of pregnancy

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ABSTRACT

Introduction: The burden of hypertensive diseases on the health care is enormous given to the high population in Sub-Saharan Africa and related disproportionate representation in global maternal mortality. **Materials and Methods:** All women with hypertensive diseases of pregnancy who got admitted into the general ICU of the University of Benin Teaching Hospital between January 2006 and December 2010 were studied. Only the records of women who completed 28 weeks of gestation and were admitted during labour and delivery or puerperium to the ICU were examined. **Results:** There were 13061 deliveries within the 5-year study period; 9301 by vaginal delivery and 3860 through Caesarean section. 52 (51.5%) of the obstetric patients had hypertensive diseases of pregnancy. Of 52 women with pre-eclampsia and eclampsia, 45/52 had caesarean section and 7/52 had SVD. Admission was mainly postpartum 48/52 (92.3%). 35/52 (67.3%) were transferred to the ward and 17 died (32.7%), giving the ICU maternal mortality rate of 307/1000 deliveries. 30 women developed pulmonary oedema alone or with renal impairment; 14 women were transferred and 16 died while 21 other patients who had renal impairment alone, HELLP, sepsis, etc were transferred out. There was about a 12-fold risk of death in the unit if the patient developed pulmonary oedema when compared to the other factors combined ($p = 0.0002$, $RR = 11.7$, $95\%CI = 1.7 - 82.$). **Conclusion:** Primiparity, unbooked status and caesarean delivery were leading factors for ICU admission in women with preeclampsia/eclampsia. The women who developed pulmonary oedema in the course of treatment had poor outcome and avoidance of pulmonary oedema may improve ICU outcome in women with preeclampsia/eclampsia.

Key words: Eclampsia, intensive care, obstetric anesthesia, preeclampsia

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INTRODUCTION

Hypertensive diseases of pregnancy, particularly preeclampsia/eclampsia, remains one of the leading causes of maternal morbidity and mortality worldwide.^{1,2} This figure is further accentuated in developing countries for which the sub-Saharan African has a disproportionate representation when compared with the developed worlds.³ The burden of hypertensive diseases on the healthcare institution is enormous given to the high reproductive activities in this region. Preeclampsia/eclampsia is associated with several maternal complications that could be acute or chronic. Eclampsia, when grand mal seizures

occur in a woman with the gestational hypertension or preeclampsia,⁴ accounts for up to 12% of deaths during pregnancy.⁵ Indeed, Nigeria was reported to have the highest rate for eclampsia not long ago.⁶

Quite often, further care for these women in the Intensive Care Unit (ICU) becomes necessary for the treatment of preeclampsia/eclampsia or for the management of associated complications. It has been suggested that intensive care management of the woman with

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preeclampsia/eclampsia may lead to better outcome and consequent improvement in the maternal mortality rate.⁷ The admission to the ICU may be for organ support, intensive monitoring or mechanical ventilation or management of the complications of preeclampsia/eclampsia. The outcomes vary because of the different severity of complications associated with preeclampsia/eclampsia. It may be necessary, therefore, to evaluate the management and outcome of critically ill patients with the hypertensive diseases of pregnancy in an ICU. Such an effort will help in identifying the patients who would benefit the most from the capital and personnel intensive care. Thus, this study determined the management and outcome of patients with severe preeclampsia and eclampsia in a level II general ICU.

MATERIALS AND METHODS

This retrospective study was performed at the University of Benin Teaching Hospital, Benin City; which is a tertiary hospital with a general ICU. The ICU is a level II facility and caters for the patients from the hospital and receives referral from other secondary and regional hospitals. The women with hypertensive diseases and associated complications were studied. Approval for the study was by institutional guidelines.

The records of the labor ward, labor ward theater, and ICU of our institution were examined to identify all women with hypertensive diseases of pregnancy who got admitted to the general ICU between January 2006 and December 2010. Only the records of women whose pregnancy went beyond the 28th completed week of gestation and were admitted during labor and delivery or puerperium (restricted to 6 weeks postpartum) were examined. For each eligible patients for the study, information on sociodemographic characteristics (age, parity, booking status, marital status, educational status, and place of delivery), gestational age at the time of identification, indication for ICU admission, and timing of admission to ICU (antepartum or postpartum) were collected on a data collection sheet. Data on ICU admission (duration of stay, therapeutic interventions during ICU admission, and maternal outcome-mortality or transferred out of the unit) were also documented. Therapeutic interventions of interest in the ICU included mechanical ventilation, renal dialysis, and use of vasoactive drugs. The outcomes of interest were mortality or transfer out of the unit to the ward.

Preeclampsia was as defined by the institutional protocol on diseases of pregnancy. Preeclampsia was diagnosed if after the 20th week of gestation the systolic blood pressure was >140 mmHg. And it is declared eclampsia if convulsion occurs in the patient. In determining the diagnosis, all the relevant medical records were reviewed

for the notation of preeclampsia/eclampsia by the attending obstetrician.

Data analyzes were performed with InStat GraphPad™. All tests were two-sided with a type 1 error rate of 5%. Continuous variables were summarized by using means (standard deviation). Dichotomous variables were presented as frequencies. The association between variables (pulmonary edema and other complications or problems in the ICU) and outcome were tested using Fisher's exact test.

RESULTS

Demographic characteristics and incidence of hypertensive diseases of pregnancy in the Intensive Care Unit

There were 13,061 deliveries within the 5-year study period; 9,301 by vaginal delivery and 3,860 through cesarean section. The number of obstetric patients admitted to the ICU was 101, out of 349 patients admitted to the ICU in the study period and representing 28.9% of total ICU admission. The incidence of obstetric admission to the ICU was 101/13,061, 7.7 per 1000 deliveries (0.8%) and accounted for 28.9% of all ICU admissions (101/349). Fifty-two (51.5%) of the obstetric patients had hypertensive diseases of pregnancy. Of 52 women with preeclampsia and eclampsia, 19/52 (36.5%) were nulliparous, 45/52 had a cesarean section, and 7/52 had spontaneous vaginal delivery. Most of the patients did not receive prenatal care 41/52 (78.8%), and over half of the patients were delivered preterm (29/52).

A high proportion of the admission was postpartum 48/52 (92.3%). The mean ICU length of stay was 5.4 ± 3.1 days.

The mean maternal age of the women with preeclampsia/eclampsia was 28.8 ± 5.8 years.

Forty patients (76.9%) had secondary education or above and others had a primary education but no patient without formal education [Table 1].

Intervention during admission in Intensive Care Unit

Table 2 shows the major interventions in the ICU to be advanced monitoring, transfusion, renal dialysis, and mechanical ventilation. Most of the patients were admitted for mechanical ventilatory support (55.8%) or advanced monitoring (44.2%). Other interventions included renal dialysis, whole blood transfusion, and use of antibiotics/vasoactive drugs (inotropic and chronotropic).

Risk factors for survival

Table 3 shows that the pulmonary edema, HELLP syndrome, and the renal impairment were the leading complications in women with preeclampsia/eclampsia. Of the 52 patients,

Table 1: Sociodemographic characteristics and clinical data

Features	Frequency
Age (years)	28.8±5.8*
Parity (%)	
Nullipara	19 (36.5)
1-3	29 (55.8)
≥4	4 (7.7)
Level of education	
None	Nil
Primary	12
Secondary	32
Tertiary	8
Gestational age	
Preterm/term	
Antenatal care	
Booked/unbooked	11/41
Mode of delivery	
Emergency C/S	43
Elective C/S	2
SVD	7
Onset of eclampsia	
Antepartum	4
Postpartum	48
Length of stay (days)	5.4±3.1*

*Mean (SD). SD – Standard deviation; SVD – Spontaneous vaginal delivery; C/S – Cesarean section

Table 2: Interventions in the ICU

Intervention	Frequency
Mechanical ventilation	29
Advanced monitoring	23
Transfusion	10
Renal dialysis	9

ICU – Intensive Care Unit

Table 3: Maternal complications in eclampsia/ outcome

Complications	Frequency (%)
Pulmonary edema alone	17
Renal impairment only	3
Pulmonary edema + renal impairment	11
HELLP	4
Others	16
Transferred out	35
Death	17

35 (67.3%) were transferred out of the unit to the ward, and 17 died (32.7%) giving the ICU maternal mortality rate of 307 per 1000 deliveries case fatality rate of 32.7%. Thirty women developed pulmonary edema alone or with renal impairment; 14 women were transferred and 16 died, while 21 other patients who had renal impairment, HELLP, sepsis, etc., were transferred out. There was about a 12-fold risk of death in the unit if the patient developed pulmonary edema when compared to the other factors combined ($P = 0.0002$, odds ratio = 11.7, 95% confidence interval = 1.7-82.).

DISCUSSION

This study shows that postpartum eclampsia was the leading reason for admission to the ICU in women with hypertensive diseases of pregnancy and mortality is very likely if pulmonary edema complicates preeclampsia/eclampsia. There is a plethora of evidence on the outcome of women with hypertensive diseases of pregnancy.¹⁻⁵ Most of these studies identified several factors as being responsible for the maternal mortality following hypertensives diseases of pregnancy. Our results highlight the effect of pulmonary edema, a complication of eclampsia/preeclampsia, on morbidity and mortality in women with preeclampsia/eclampsia.

Over a third of the women were nulliparous. Preeclampsia/eclampsia is thought to be a disease of the young and low parity. This is in keeping with epidemiological evidence of preeclampsia as being common in first pregnancy. Several studies in Nigeria^{8,9} and elsewhere indicate that 39-44% of women with preeclampsia are nulliparous and similar to our observation. The relative preponderance of the disease in nulliparous women implies a higher representation in the associated mortality.

Another sociodemographic characteristic of interest in this population is the lack of prenatal care in a sizable proportion of the women. The nonutilization of antenatal services has been recognized as a critical factor in poor outcome in pregnant women.^{10,11} Indeed, a study demonstrated a 10-fold increase in maternal mortality rate in women who did not attend the antenatal clinic in a resource poor setting.¹² The consequences of lack of prenatal care are further compounded when these women receive the emergency obstetric care often resulting in surgical delivery. This formed over half of the patients in this study and similar to other reports.⁹ In fact, Singh *et al.*¹³ had demonstrated that the women with hypertensive disorder were more likely to receive cesarean section than normotensive women. It is imperative therefore that these women are educated to attend the prenatal classes as this appears to play a role in the maternal outcome.

Critical care management has been advised for pregnancies complicated by preeclampsia.⁷ This is necessary as preeclampsia is a multisystem disorder requiring a multidisciplinary approach to management. Mechanical ventilatory support and advanced monitoring were the major interventions in this study. Specifically, preeclamptics/eclamptics with altered consciousness would often require the intervention to maintain the adequate oxygenation while minimizing metabolic activities in other organs. It may have been necessary to determine the duration of ventilation for each patient so as to provide insight into the severity of the respiratory impairment. However, a study that had a relatively high incidence of mechanical ventilation observed that the

patients had the intervention for a short duration.¹⁴ Furthermore, the delivery of the pregnant woman does not appear to offer the same benefit in respiratory failure as does in preeclampsia/eclampsia.¹⁵ This understanding is important to the ventilatory care of these patients.

The development of pulmonary edema alone or with any other complication of preeclampsia was a risk factor for poor outcome. The mechanism for the development of pulmonary edema is important to understand the course of the disease. A study showed that 89% of women who developed acute pulmonary edema had preeclampsia.¹⁶ It is therefore, a common complication of preeclampsia and several factors have been implicated. These include endothelial damage and consequent fluid leakage,^{17,18} maternal age, cesarean delivery, increased body mass index and unrecognized cardiomyopathy.¹⁹ Endothelial damage is a recognized etiopathogenesis in preeclampsia, and a good proportion of patients also had cesarean delivery; two factors that have been implicated in the development of pulmonary edema in preeclampsia/eclampsia. Preeclampsia/eclampsia presents the patient with global hypoproteinemia. It may have been necessary to determine volume and type of fluid used for the peripartum treatment of these women prior to admission to ICU. A study showed that the incidence of pulmonary edema in pregnant women was higher in women who received crystalloids during treatment.¹⁶ This may have provided further insights into the cause of the pulmonary edema as being pathogenetic or iatrogenic fluid loading. Nonetheless, it is important to restrict fluid administration in this population of patients.

Some have argued for a tradeoff between the restricted use of fluid and the risk of development of acute renal failure. It is believed that acute tubular necrosis could be reversed with renal dialysis and the means of overturning pulmonary edema is limited. Our data are inclined toward the avoidance of pulmonary edema as the associated morbidity and consequent mortality in women with preeclampsia/eclampsia is high. A study that compared the outcome in two centers with restricted and liberal fluid administration demonstrated that increasing the volume of fluid results in increasing risk of morbidity in women in the peripartum period.¹⁶ It is pertinent to avoid as many complications as possible. If for any concern of fluid administration, it appears the suggested 80 ml/h^{20,21} may be sufficient to reduce the risk of either pulmonary edema or renal impairment.

There are limitations to the interpretation of our results. First, this was a retrospective study with clear difficulties such as incomplete records, poor documentation, or missing information. The review of multiple sources of clinical information was employed to minimize these concerns. Second, only patients admitted to the ICU were studied. There may have been some patients with severe preeclampsia/eclampsia who did not come to the ICU and were missed out.

This notwithstanding, the association of pulmonary edema with poor outcome in women with preeclampsia/eclampsia admitted to the ICU underscores the importance of this study. Fluid restriction and avoidance of pulmonary edema in the course of therapy may improve outcome.

CONCLUSION

This retrospective study to determine the outcome of women with preeclampsia/eclampsia admitted to the ICU showed that primiparity, unbooked status, and cesarean delivery were associated factors for ICU admission. Furthermore, women who developed pulmonary edema in the course of treatment had a poor outcome. Avoidance of pulmonary edema in the course of therapy may improve outcome in women with preeclampsia/eclampsia admitted to the ICU.

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Conflicts of interest

There are no conflicts of interest.

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