Retrospective study in cases of pregnancy-induced hypertension admitted to the ICU at Women Health Teaching Hospital of Assiut University

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Objective
The aim of the study was a retrospective analysis of the causes and risk factors of ICU admission, postoperative management, and outcomes of patients with pregnancy-induced hypertensive disorders.

Background
Hypertensive disorders of pregnancy, including severe preeclampsia and eclampsia, complicate about 10% of pregnancies worldwide, constituting one of the chief causes of maternal and perinatal morbidity and mortality worldwide.

Patients and methods
Our retrospective study included 186 cases of antenatal and postpartum severe preeclampsia and eclampsia patients admitted to the ICU in Assiut Woman Health Hospital in 24 months. All patients showed manifestations of severe preeclampsia or eclampsia. The study obtained an institutional ethical approval.

Results
In this study, the most frequent complication was HELLP (hemolysis, elevated liver enzyme levels, and low platelet levels) syndrome that occurred in 25 (13.44%) women followed by renal impairment, cerebral hemorrhage, and pulmonary that occurred in 11 (5.91%), 10 (5.37%), and nine (4.83%) women, respectively. Unfortunately, permanent blindness affected three (1.61%) women in this study and 12 (6.45%) women encountered death. Improvement occurred in 160 (86%) women, whereas six (3.22%), five (2.28%), and five (2.68%) women were transferred to other departments namely neurological, nephrological, and cardiology wards, respectively.

Conclusion
Reducing maternal morbidity and mortality, pregnancy-induced hypertension patients require early admission and appropriate management in the ICU.

Keywords:
eclampsia, ICU, severe preeclampsia

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Introduction

Obstetric admissions to the ICU and maternal mortality continue to have a significant impact on maternal healthcare, despite the low rate of such admissions in developed countries. Unlike others, obstetric patients pose a major management challenge to ICU physicians and obstetricians due to altered physiology during pregnancy, consideration of fetal well-being, and the unique type of disorders to be dealt with [1].

Severe preeclampsia, either alone or superimposed on preexisting (chronic) hypertension, presents the major risk. Although appropriate prenatal care, with observation of women for signs of preeclampsia and then delivery to terminate the disorder, has reduced the number and extent of poor outcomes, serious maternal-fetal morbidity and mortality still occur. Some of these adverse outcomes are avoidable, whereas others can be ameliorated [2].

Hypertensive disorders of pregnancy include severe preeclampsia and eclampsia, and complicate about 10% of pregnancies worldwide, constituting one of the main causes of maternal and perinatal morbidity and mortality worldwide The incidence of preeclampsia has increased by 25% in the USA during the past two decades [3].

Severe preeclampsia is a risk factor for future cardiovascular disease and metabolic disease in women [4].

The most common indications for admission to the ICU of patients with pregnancy-induced hypertension include but are not limited to refractory hypertension,

neurological dysfunction (intracranial hemorrhage, seizures, and elevated intracranial pressure), liver or kidney dysfunction, pulmonary edema, HELLP (hemolysis, elevated liver enzyme levels, and low platelet levels) syndrome, and/or disseminated intravascular coagulopathy [5,6].

Anesthetists are frequently involved in the multidisciplinary management of critically ill women with preeclampsia, and clinical practice should be based on this scientific evidence [7].

The aim of this study was retrospective analysis of the causes and risk factors of ICU admission, postoperative management, and outcomes of patients with pregnancy-induced hypertensive disorders admitted to the ICU of Assiut Woman Health Hospital (WHH).

Patients and methods

This retrospective analysis included 186 cases of antenatal and postpartum severe preeclampsia and eclampsia patients admitted to the ICU of Assiut WHH between 1 January 2015 and 31 December 2016 (24-month period). All patients have been diagnosed to have severe preeclampsia or eclampsia at the time of admission to the ICU. The study obtained an institutional ethical approval.

Diagnosis for severe preeclampsia was based on developing of newly-onset elevation of systolic blood pressure (BP) of more than 160 mmHg or diastolic BP of more than 110 mmHg on two occasions 4 h or more apart while the patient is on bed rest, and may be with one or more of the following:

(1) Thrombocytopenia (platelet count <100 000/mm^3).
(2) Impaired liver function as indicated by abnormally elevated blood levels of liver enzymes (twice normal concentration).
(3) Severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by alternative diagnoses, or both.
(4) Progressive renal insufficiency (serum creatinine >1.1 mg/dl or a doubling of the serum creatinine in the absence of other renal disease).
(5) New-onset cerebral or visual disturbances, pulmonary edema.

Diagnosis of eclampsia establishing on the presence of new-onset grand mal seizures in woman with preeclampsia during pregnancy or after delivery and no other reason for this.

Interventions

(1) Resuscitative measures:
    (a) The usual airway, breathing, circulation checkup protocol and maneuvers: Checking pulse is the most important thing to do in the circulation part, also checking the tongue not to be bitten by the teeth or retracted backwards is the most important to check in the airway especially if the patient is coming with fits attack, finally the breathing is checked if patent or not.
    (b) Control of fits: It were done after securing the airway, breathing, circulation rapidly by midazolam ampule IV and repeated if needed; magnesium sulfate 4 g as a loading dose of more than 30 min was administered and then 1 g/h as a maintenance, stopped if absence of patellar reflexes, anuria, heart block, or respiratory arrest had been occurred. Reloading of magnesium sulfate if new fits occur later on.
    (c) Emergency control of BP: It was done before termination of pregnancy by vasodilators such as glyceryl trinitrate infusion if BP of more than 180/110, nifedipine tablet, α-methyldopa tablet, captopril tablet, and atenolol tab.
(2) Maintenance treatment: was changed according to every case.
(3) Mechanical and invasive interventions according to the case such as:
    (a) Central venous line.
    (b) Arterial blood gases.
    (c) Blood transfusions.
    (d) Mechanical ventilation.
    (e) Renal dialysis.

Consultation to another specialist in any department such as nephrology, neurology, or cardiology.

(4) Monitoring include:
    (a) Noninvasive BP.
    (b) Five-lead ECG.
    (c) Pulse oximeter.
    (d) Urine output.
    (e) Bleeding.
    (f) Fits.
    (g) Appearance of any symptoms indicate new complications.
(5) Management of complications such as:
    (a) Pulmonary edema.
    (b) Acute renal failure.
    (c) Neurological deficits.
(6) Discharge of the patient included either if:
    (a) Recovered completely or there is some residual symptoms which will resolve after short period.

(b) Complicated so it will discharge with permanent effect or referral to other departments.
(c) Mortality occurs in the ICU.

(7) Data collection:

We collected the data of general information such as age, pregnancy time, first pregnancy or not, multiple births or not, admission BP (mmHg), tic during transference; and data after patient in the ICU such as Acute Physiology and Chronic Health Evaluation (APACHE) II score, complications such as HELLP, heart failure, multiple organ dysfunction syndrome, infection, days in the ICU, and cerebrovascular complications of patients. The studied data included laboratory test parameters, diagnostic and therapeutic interventions, rate of morbidity and mortality and its related factors, and the average duration of ICU stay.

Results

Demographic and obstetric data of enrolled patients

This study included 186 women with a mean age of 26.19 ± 6.21 years and range between 19 and 42 years. It was noticed that 142 (76.34%) of them were between 18 and 30 years old, 35 (18.81%) were between 30 and 40 years old, whereas only nine (4.85%) were 40 years or over. Majority (51.6%) of enrolled women were nulliparous and the other who were multiparous with median parity was 5 and range between 1 and 7 times. Mean gestational age was 34.77 ± 3.14 weeks with a range between 24 and 40 weeks (Table 1).

Clinical data and time of delivery in this study

Early preterm and late preterm presented in 40 (21.5%) and 105 (56.45%), respectively, with full-term delivery having occurred in 33 (17.74%) cases. Normal vaginal delivery occurred in only five (2.68%) cases, whereas vaginal abortion was done in six (3.22%) and cesarean section was done in the majority (94%) of cases. Regarding the timing of pregnancy-induced hypertensive disorders in this study, antepartum eclampsia occurred in 80 (43%) cases, whereas postpartum eclampsia occurred in 20 (10.7%) cases. Severe preeclampsia occurred in 86 (46.23%) cases of women (Table 2).

Baseline laboratory data in this study

Elevated liver enzymes and anemia were seen in all women. Range of APACHE II score was between 8 and 15 with a mean of 11.89. Other data are summarized in Table 3.

Table 1 Demographic and obstetric data of enrolled patients

Variables	*n*=186
Age (years)	26.19±6.21
Range	19-42
Age groups (years)	
18-30	142 (76.34)
30-40	35 (18.81)
>40	9 (4.85)
Parity	
Nulliparous	96 (51.6)
1-4	45 (24.2)
Grand multipara	45 (24.4)
Gestational age (weeks)	34.77±3.14
Range	24-40

Data were expressed in the form of mean (SD) and frequency (%).

Table 2 Clinical data and time of delivery in this study (*n*=186)

Blood pressure on admission	
Systolic blood pressure (mmHg)	174.35±13.26
Diastolic blood pressure (mmHg)	100.21±7.73
Mean arterial blood pressure (mmHg)	124.75±7.73
Duration of pregnancy (*n*=186)	
Early preterm (>28 to ≤32 weeks)	40 (21.5)
Late preterm (>32 to ≤37 weeks)	105 (56.45)
Full-term (38-42 weeks)	33 (17.74)
Abortion (≤28 weeks)	8 (4.3)
Type of delivery (*n*=186)	
Normal vaginal delivery	5 (2.68)
Cesarean section under spinal anesthesia	70 (37.63)
Cesarean section under general anesthesia	105 (56.45)
Abortion	6 (3.22)
Timing of pregnancy-induced hypertensive disorders (*n*=186)	
Severe preeclampsia (de-novo superimposed)	86 (46.23)
Antepartum eclampsia	80 (43)
Postpartum eclampsia	20 (10.7)

Data were expressed in the form of mean (SD) and frequency (%).

Table 3 Laboratory data (on admission) in this study

Parameters	Mean±SD
Prothrombin time (s)	12.11±0.98
Prothrombin concentration (%)	84.31±13.69
Aspartate transaminase (U/l)	160.45±13.98
Alanine transaminase (U/l)	118.40±23.67
Hemoglobin (g/dl)	9.68±1.76
Platelets ($\times 10^3/mm^3$)	141.71±68.81
Urea (mmol/l)	32.65±3.5
Creatinine (μmol/l)	109.84±13.76
APACHE II score	11.89±2.56

APACHE II, Acute Physiology and Chronic Health Evaluation.

Outcome of the women included in this study

Median ICU stay was 4 with a range between 2 and 16 days. Seventeen (9.14%) women needed mechanical ventilation, according to the number of days every case needs it, there were four cases that needed 3 days, three cases needed 2 days, two cases needed 2 days, three cases needed 8 days, two cases needed 5 days, one case needed 6 days, one case needed 10 days, and another case needed 11 days.

Dialysis was done in 16 (8.60%) women, according to the number of sessions done to each case, there were nine cases who had one session, two cases had two sessions, and five cases had three sessions (Fig. 1).

The most frequent complication in this study was HELLP syndrome that occurred in 25 (13.44%) followed by renal impairment, cerebral hemorrhage, pulmonary edema, and temporary blindness that occurred in 11 (5.91%), 10 (5.37%), nine (4.83%), and 15 (8%) women, respectively (Fig. 2).

Unfortunately, permanent blindness affected three (1.61%) women in this study and death was the outcome in 12 (6.45%) women, according to the cause of death, cerebral hemorrhage was the cause in three cases, pulmonary edema was the cause in three cases, disseminated intravascular coagulation was the cause in another three cases, whereas acute renal failure was the cause in two cases, sepsis was the cause of death in only one case.

Improvement occurred in 160 (86%) of the cases, whereas six (3.22%), five (2.28%), and five (2.68%) women were transferred to the neurological ward due to permanent deficits such as hemiplegia, nephrological ward due to renal failure, and cardiology ward due to heart failure, respectively.

Division of enrolled women based on the onset of eclampsia

In the majority (80%) of cases who had antepartum eclampsia and postpartum eclampsia presented in 20 (20%) women with eclampsia. There were no significant differences between both groups with exception of gestational age that was significantly prolonged in those women with postpartum eclampsia (32.17 ± 2.15 vs. 36.13 ± 3.53, P = 0.01) and the ventilated cases was more in antepartum eclampsia cases [seven (41.17%)] than postpartum eclampsia [three (17.64%)] of the totally ventilated cases (Table 4).

Statistical analysis

Data were collected and analyzed using the statistical package for the social sciences, version 20 (IBM Corp., Armonk, New York, USA). Continuous data were expressed in the form of mean ± SD or median (range), whereas nominal data were expressed in the form of frequency (%). χ^2-test was used to compare the nominal data of different groups in the study, whereas Student's t-test was used to compare the mean of two different groups. P value was significant if less than 0.05.

Discussion

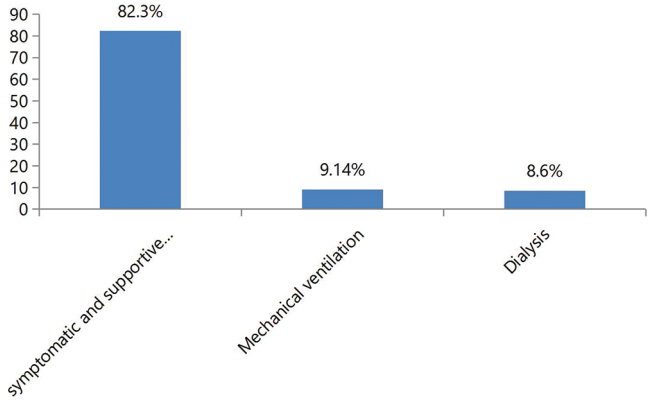
It is well known that the major three causes of maternal death are pregnancy-induced hypertensive disorders, thromboembolic diseases, and postpartum hemorrhage. Eclampsia is considered a serious stage that affects harmfully both the fetus and the mother and early detection with prompt therapy encourages better outcome [8].

Table 4 Division of enrolled women based on the onset of eclampsia

Variables	Onset of eclampsia		*P*
	Antepartum (*n*=80)	Postpartum (*n*=20)	
Age (years)	26.09±6.99	25.94±7.02	0.12
Gestational age (weeks)	32.17±2.15	36.13±3.53	0.01*
Nulliparous (*n*=96)	49 (51)	47 (49)	0.22
Ventilation (*n*=10)	7 (41.17)	3 (17.64)	0.23
APACHE II	11.02±2.44	10.92±2.01	0.22
Cerebral hemorrhage (*n*=5)	3 (17.64)	2 (11.76)	0.19
Death (*n*=6)	3	3	0.23
ICU stay	4 (3-14)	4 (2-16)	0.71

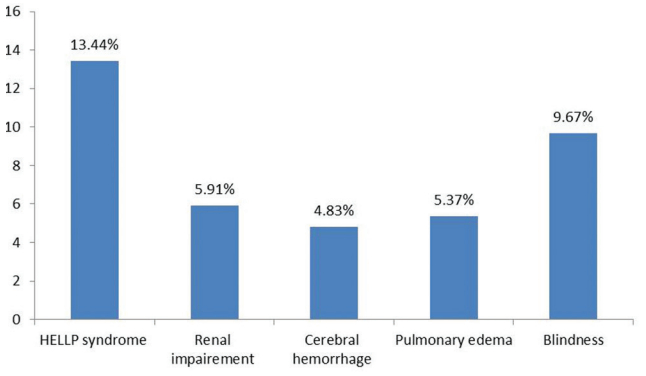
Data were expressed in the form of mean (SD), median (range), and frequency (%). APACHE II, Acute Physiology and Chronic Health Evaluation. P<0.05, significant.

Figure 1



Intervention in this study.

Figure 2



Complications that occurred in this study. HELLP, hemolysis, elevated liver enzyme levels, and low platelet levels.

Many previous studies reported that 2.3–4.6% of pregnant women are liable to develop preeclampsia and out of them 2.3–4.2% are at risk to be complicated with eclampsia. It was notices that the incidence of preeclampsia is decreasing but the incidence of development of eclampsia on top of preeclampsia is increasing [9].

It can be seen that eclampsia remains an economy-related disease, and knowledge about it should be spread in rural areas. Strengthening antenatal care, early detection of pregnancy-induced hypertension syndrome, and prevention of eclampsia is the fundamental measure. To obtain successful rescue of the women in severe conditions before and after delivery an obstetric management and comprehensive monitoring of ICU and emergency treatment are needed [10].

One of the main causes of admission in pregnant women is hypertensive disorders of pregnancy with their varying single or multiple organ system involvement. Atashkhoei and Lame [11] reported that severe preeclampsia, eclampsia and HELLP syndrome were the major causes for maternal ICU admission in our hospital in 0.6% of all deliveries. Other reported rate was that about 0.4–2.4% of all deliveries will need ICU admission [12].

To rescue the affected women with this disorder, termination of pregnancy is required and studies recommended a cesarean section to save eclampsia patients. With this termination, BP can be reduced, thus decreasing the possibility of repeated tics [13].

Majority of women in this study came to hospital after onset of eclampsia and a large number of them had no antennal care. In comparison with this study, the mean age of enrolled women in the study by Atashkhoei and Lame [11] was 29.36 ± 5.3 years and was 26.7 ± 6.69 years with range between 17 and 41 years as reported by Zhang *et al.* [14].

Zhang *et al.* [14] reported that out of 165 cases included in the study, 126 women had antepartum eclampsia, 27 women had postpartum eclampsia, and 12 cases had antepartum and postpartum eclampsia. In this study, regarding the onset of eclampsia in this study, antepartum eclampsia occurred in 80 (80%), whereas postpartum eclampsia occurred in 20 (20%) women.

According to gestational weeks of patients, we divided the patients into three groups: <34, 34–36, ≥37. From the statistics we can see that pregnant women at group older than 37 weeks or more women are the youngest, and percentage of first marriage is the highest. That is to say gestational weeks of young and first pregnancy women are obviously longer than older and second-pregnancy women. In this study, it was noticed that the need for mechanical ventilation and long stay at ICU were frequently observed in those women with a gestational age of younger than 34 weeks. Other previous studied reported that mechanical ventilation and hospital stay would be prolonged as the gestational was below 34 weeks [14].

Many previous studies reported that eclampsia commonly occurred in antenatal more than in postpartum cases and to a lesser extent both antenatal and postpartum types may occur. This was constant with our result with the exception that no case in this study had both types. It was noticed that age of the two groups was not significantly different. Gestational weeks of postpartum cases were obviously longer than antenatal eclampsia patients. APACHE II score, time in the ICU, and cerebrovascular disease condition were not significantly different.

There are many theories that explained the pathophysiology of postpartum eclampsia, but it is accepted now that most of such cases are mostly caused by pain after operation, invasive treatment, ineffective control of BP, and existence of other complications, and should be paid attention to [11].

Severe preeclampsia and its associated complications are considered as the leading main indications for ICU admission. The most common indications for admission to the ICU of patients with pregnancy-induced hypertension include but are not limited to refractory hypertension, neurological dysfunction (intracranial hemorrhage, seizures, and elevated intracranial pressure), liver or kidney dysfunction, pulmonary edema, HELLP syndrome, and/or disseminated intravascular coagulation [15].

The most frequent complication in this study was HELLP syndrome that occurred in 25 (13.44%), followed by renal impairment, cerebral hemorrhage and pulmonary that occurred in 11 (5.91%), 10 (5.37%) and nine (4.83%) women, respectively. Unfortunately, permanent blindness affected three (1.61%) women in this study and death was the outcome in 12 (6.45%) women.

The current overall incidence of death in the developed world is low, varying from 0.2 to 0.4/1000 but the rate in developing countries is as high as 10% of the deliveries and death rate of eclampsia patients is largely increased due to concurrent hypoxic ischemic encephalopathy or intracranial hemorrhage. A high incidence (21.4%) of maternal death among preeclamptic women was reported [7]. Incidence rate of HELLP syndrome

among severe preeclampsia patients is 4–12%, whereas the incidence of cardiac insufficiency among preeclampsia patients is 6–9% [16].

Approximately, 7.1% of the cases with coagulation problems had blood product transfusion. There were no neonatal death in any women and intrauterine complications occurred in 19.6% patients. Similar to other studies, the common problems include refractory hypertension, pulmonary edema, heart failure, seizure, and coagulopathy [5].

Median ICU stay was 4 with range between 2 and 16 days. Seventeen (9.14%) women needed mechanical ventilation and dialysis was done in 16 (8.60%) women. Other studies as reported by Zhang *et al.* [14] showed that hospital stay ranged between 1 and 11 days and mechanical ventilation was needed in 34.5% of cases.

Patients were transferred to different wards from the ICU when conditions improved. For example, patients with cerebrovascular complications were transferred to the Neurology Department; patients with cardiac lesions or dysfunction were transferred to Cardiovascular Department, and patients with kidney dysfunction were transferred to Renal Department and patients with liver dysfunction were transferred to the liver disease ward [9]. Patients in our hospital were mainly transferred to Obstetric or Neurology Department. Improvement occurred in 160 (86%) cases, whereas six (3.22%), five (2.28%), and five (2.68%) women were transferred to the neurological ward, nephrological ward and cardiology ward, respectively.

Zhang *et al.* [14] showed that ultimate prognosis of patients was satisfactory. Except three cases of large-area cerebral hemorrhage and one case of left headache from sagittal sinus thrombus, all recovered and left hospital [14].

Conclusion

Severe preeclampsia, eclampsia, and their complications are the most common maternal indications requiring ICU admission in Assiut WHH. To reduce maternal morbidity and mortality, these patients require early admission and appropriate management in the ICU. A healthy respect for this condition, coupled with aggressive and early intervention may be able to minimize adverse maternal and perinatal events in the setting of severe preeclampsia.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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