

Maternal and Fetal Consequences of Preeclampsia

Z Nwosu, M Omabe

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Abstract

About 6 to 8 percent of all pregnancies, especially primigravidae is complicated by preeclampsia, a classical triad of elevated blood pressure, proteinuria and edema. Maternal and neonatal morbidity and mortality are of utmost concern as the etiology of preeclampsia is uncertain. At-risk pregnant women can be suspected if they are primigravidae, multiparous, obese, diabetic, hypertensive, or if they have familial history of hypertension, diabetes, or renal vascular disease. Progression to severe preeclampsia is usually followed by such devastating consequences, but Patients chances of survival are reportedly maximized if they are delivered of the baby, the survival advantage of the latter been a function of the extent of maturity for the gestational age. Early identification of high-risk pregnant women and subsequent monitoring, are surely pivotal steps in prevention, while subsidization of antenatal services especially in developed countries will significantly reduce the global burden of the condition in the years to come.

INTRODUCTION

Preeclampsia, a hypertensive disorder in pregnancy is believed to be one of the leading causes of maternal and fetal mortality and morbidity worldwide.^{1,2,3} It is a classical triad of hypertension, proteinuria and edema, defined as “a new onset of elevated blood pressure of 140/90 mm Hg or more, recorded on two separate occasions at least 6 hours apart and in the presence of at least 0.3g of protein in a 24 hour urine, arising after the 20th week of gestation in a previously normotensive patient, and resolving completely between 6-12 weeks after delivery”.⁴ Preeclampsia (formerly called toxemia of pregnancy) is a multisystem disorder affecting about 6 to 8 percent of pregnant women.⁴

ETIOLOGY

The pathogenesis of preeclampsia is incompletely understood, but hypotheses strongly suggest placental malformation³ leading to placental release of substances capable of causing endothelial dysfunction, which deteriorates to maternal endothelial damage.⁵ Endothelial dysfunction arising from uteroplacental insufficiency has also been underscored.^{5,6,7} In normal pregnancy, placentation involves invasion of the decidua by the syncytiotrophoblast to create an enabling environment for the developing blastocyst. The loss of musculoelastic vascular walls results in dilated vessels, which are incapable of vasoconstriction, hence, decreased blood pressure and maximum placental perfusion is established. The increased perfusion may be as a

result of increased synthesis of vasodilatory prostaglandins (particularly prostacyclin) and endothelial derived nitric oxide in one hand, and decreased arteriolar sensitivity to the pressor effect of angiotensin II on the other.⁸ Prostaglandins (PGE₂) are synthesized from arachidonic acid by a phospholipase A₂ and cyclooxygenase (COX) catalysed reaction. The PGE₂ is involved in regulation of decidualization of the endometrial stromal cells.⁹

RISK FACTORS FOR PREECLAMPSIA

Risk factors include extreme ages (less than 20 years and greater than 35 years), multiple gestations, history of diabetes, hypertension, renal and vascular insufficiency, African-American heritage, changing paternity in subsequent pregnancies, hydatidiform mole, fetal hydrops, and nulliparity. Predisposing factors include nulliparity, previous history of preeclampsia, familial history of pregnancy induced hypertension, renal and vascular insufficiency, smoking and obesity as well as pregnancies complicated by fetal hydrops. Seely and Solomon¹⁰ linked the development of preeclampsia to increased insulin resistance that occur during late pregnancy in women with history of preeclampsia, while the disease has also been suggested to be the first manifestation of metabolic syndrome in at risk women.¹¹ Paulson et al¹² showed that there is an increased risk of preeclampsia in pregnant women above 50 years or in women of advanced reproductive age. The condition is characterized by widespread physiologic changes including

vasospasm, activation of the coagulation system and disturbance in the humoral and autacoids balance, which is contiguous with immediate consequences.

MATERNAL CONSEQUENCES OF PREECLAMPSIA

SOME PATHOPHYSIOLOGIC EXPLANATIONS

Preeclampsia has been described as a problem of early placentation insult resulting in an aberrant development and differentiation of the villous syncytiotrophoblast which causes impaired maintenance of the placental barrier.³ Maternal complications results from placental hemorrhage and ischemia that on the long run distort fetal growth and maternal well-being. Placental abruption (also called abruptio placentae) is an abnormal uterine bleeding resulting from placental detachment from maternal uterine wall. The detachment is due to repulsion of the placenta by the decidua basalis. The bleeding that follows may be overt (external) via the vagina, or may pool behind the placenta (concealed or internal). Placental abruption mostly occurs close to term, or frequently during labour. The predisposing factors to the condition include maternal hypertension, trauma (accident or nosocomial), retroplacental fibromyoma, extreme maternal ages, drugs, and previous abruption. The association of preeclampsia to intrauterine growth restriction¹³ may be explained by diminished blood and nutrient supply to fetus that might possibly follow placental detachment. The initiation of preeclampsia is broadly hinged on uterine vascular changes and/or endothelial dysfunction as stated in some literatures.^{3, 14} During implantation, mutual immunologic tolerance develops between the fetal allograft and maternal decidua with the cytotrophoblasts invading the uterine spiral arteries to reach the decidual segment, the upper one-third of the myometrium been finally invaded by the 18th week.^{6,9} This allows the trophoblasts to be in direct contact with the maternal blood, thus establishing the uteroplacental circulation.¹⁵ This invasion is suggested to lead to degeneration and replacement of the tunica media of spiral arteries by fibrinoid materials. This results in marked dilatation of the arteries and increased intervillous blood flow.¹⁶ In preeclampsia, the endovascular trophoblastic invasion remains superficial, rarely reaching the myometrial segments and so spiral arteries remain muscular, undilated and responsive to vasomotor influences.¹⁵ Consequently, uteroplacental perfusion is reduced with necrosis of vessel walls and luminal occlusion by aggregates of fibrins, platelets and lipid-laden macrophages. There is also fibrin deposition in the intervillous spaces in preeclamptic

women.¹⁷ Staun-Ram and Shaley⁹ suggested that the mediators that might be involved in poor trophoblasts invasion include Epidermal Growth Factor (EGF), Human Chorionic Gonadotropin, Transforming growth factor β (TGF- β), and Vascular endothelial growth factor (VEGF). Disturbance of endothelial integrity leading to increased vascular reactivity, activation of the coagulation cascade and multi-system damage has been implicated in the development of hypertension in pregnancy. In preeclampsia, the normal function of the endothelium in maintaining vascular tone is lost.

Currently, preeclampsia, presumably occurring at the fetomaternal interface, is due to alteration in the endothelial derived vasodilator/vasoconstrictor autacid balance, which leads to increased microvascular reactivity.⁹ The ultimate result is decreased synthesis of endothelial derived vasodilators (prostacyclin and nitric oxide), while synthesis of vasoconstrictors (endothelin-1 and thromboxane A₂ of placental origin) increases, hence, platelet aggregation and increased peripheral resistance both account for the disseminated intravascular coagulopathy and highly elevated blood pressure seen in preeclampsia.¹⁶ Also, decreased arteriolar sensitivity to angiotensin II observed in normal pregnancy is lost, so that there is increased arteriolar sensitivity to the vasoconstrictor in preeclampsia. There is also a possibility that endothelial dysfunction may stimulate platelet and neutrophil activation via increased expression of endothelial vascular adhesion molecules (VCAM) further exacerbating the vascular damage with thrombin and fibrin generation.¹⁸ Recently proposed^{3,5} mechanism attributes preeclampsia to circulating factors like soluble fms-like tyrosine kinase (sFlt-1) – an antiangiogenic marker that inhibit cytotrophoblastic differentiation and invasion by binding to placental growth factor (PlGF) and vascular endothelial growth factor (VEGF).^{9,19,20}

sFlt-1 normally increases while PlGF and VEGF decreases⁶ near term which shows a reduction in angiogenesis towards delivery; however, in preeclampsia, this angiogenic break occurs much earlier than in normal pregnancy.²¹ It is believed that larger amount of sFlt-1 is produced when the placental trophoblast is exposed to stressful condition like hypoxia as is the case in preeclampsia.^{22,23} Zhou et al²² reported that IgG from preeclamptic women plays the role of stimulating sFlt-1 synthesis in human trophoblast cells through AT₁ (Angiotensin 1) receptor activation. Other circulating factors that may contribute to endothelial dysfunction and possibly neutrophil activation includes lipid

peroxidation degradation products, reactive oxygen species (ROS) and cytokines (TNF- α and IL-6), all of which are found to be increased in preeclamptic women. In preeclampsia, soluble endoglin (an antiangiogenic protein which inhibits TGF- β signaling in vessels is also raised.²⁴ That genetic susceptibility may be a factor in the pathogenesis of preeclampsia has been suggested. Duckitt and Harrington²⁵ stated that daughters of preeclamptic mothers have 3 to 4 times increased chances of developing the syndrome than daughter-in-laws. Maternal and paternal genetic factors are believed to be responsible for preeclampsia, this comprises the conditions under which maternal and fetal genotypic concordance changes, such as changing paternity in multiparous pregnancies and paternal familial history of preeclampsia.⁴ Failure of immunologic tolerance between fetal allograft and maternal decidua has been suggested, as well as oxidative modification of low-density.

HYPOVOLEMIC SHOCK

Since hemorrhage may be internal and hidden in preeclampsia, serious blood loss may have occurred before detection, hence, hypovolemic shock may ensue – necessitating fluid replacement. Circulating volume of blood may drop to minimum, with decreased venous return, cardiac output, and ultimately hypotension. Maternal target organs are affected as blood and oxygen supply is retarded.¹⁸ Lactic acidosis, respiratory distress, disseminated intravascular coagulation, and organ ischemia and necrosis all follow decreased blood, oxygen and nutrient supply. Perfusion is also decreased²⁶ due to vascular hemoconcentration and third spacing of intravascular fluid, exaggerated inflammatory response and inappropriate endothelial activation; the resultant microthrombi formation further compromising blood supply to organs.²⁷

Following hemorrhage, mothers may be sensitized by fetal blood group antigen that can culminate to hemolytic disease of the newborn in a rhesus D negative mother carrying a rhesus D positive fetus. In severe cases of hypovolemia, the lungs become congested with fluid leading to pulmonary edema. Gamzu et al²⁸ suggested possibly increased red blood cell (RBC) aggregation and the probability that the aggregated RBCs will contribute to decreased capillary flow, increased peripheral resistance, and relative tissue ischemia.

DISSEMINATED INTRAVASCULAR COAGULATION

Consumptive coagulopathy resulting from generalized

activation of coagulation system leads to continual bleeding as fibrin clotting factors and platelets are all consumed.²⁹ Indicators of the activation of coagulation systems are decreased concentration of antithrombin III (inhibitors of fibrin formation), prolonged activated partial thromboplastin time, prothrombin time test, thrombocytopenia (platelet count less than $100 \times 10^9/L$), and increased fibrin degradation products (FDPs). Stalker²⁹ in his work cited some studies that upheld the fact the fibrin deposition occurs in the renal glomerular capillaries in preeclampsia with attendant endothelial cell swelling, and agreed that intravascular coagulation is part of the disease process. The occurrence of DIC in severe preeclampsia has been attributed to alterations in coagulation fibrinolytic system components like the plasminogen activator inhibitor 1 (PAI)-1.²⁶

RENAL FUNCTION

Following hypovolemia, hypotension and disseminated intravascular coagulation, decreased renal blood supply results in acute renal failure; oliguria and acute tubular necrosis may become imminent if care is not taken. The vasospasm and swelling of glomerular endothelial cell (glomeruloendotheliosis) leads to a reduction of glomerular filtration rate by about 25 percent below normal. Serum creatinine is elevated, while serum uric acid level is very markedly raised. The elevated uric acid level has been associated with lactic acidosis, altered renal function, or oxidative stress.²³ The bifunctional enzyme (xanthine oxidase/dehydrogenase) forms uric acid and either of reduced nicotinamide-adenine dinucleotide or superoxide, in its oxidase or dehydrogenase form respectively. The expression of the enzyme is upregulated in hypoxic condition as seen in severe preeclampsia.²³ Most notable is the elevation of urinary protein – this been ordinarily an acknowledged indicator of disturbed renal integrity. Greater than 0.1g of protein is excreted in a random urine specimen or 0.3g in a 24-hour specimen after the 20th week in a preeclamptic woman.

According to ACOG Committee on Obstetric Practice,¹ one of the diagnostic criteria for severe preeclampsia is a protein concentration of more than 0.5g in a 24-hour urine specimen. Sudden inability of the kidney to excrete waste products of metabolism actually may account for the oliguria. Tubular obstruction by intraluminal casts, debris and interstitial edema may decrease glomerular filtration rate because of increased hydrostatic pressure in the Bowman's capsule. Preeclampsia has also been associated with increased relative risk for end stage renal disease.³⁰

CARDIOPULMONARY DISTURBANCES

In severe preeclampsia, further elevation of blood pressure above 160/110 mm Hg may lead to cerebral hemorrhage and cardiac decompensation. Cardiac failure may follow, and is one of the most common causes of maternal death in preeclampsia. As vasospasm worsens, capillary endothelial damage increases systemic capillary permeability with leakage, leading to increased hemorrhage and edema.³¹ Germain et al³¹ suggested that endothelial dysfunction may be a triggering mechanism for pregnancy-associated complications and long term risk for CV disease. Pulmonary ischemia due to hypoperfusion and aggregation of platelets in pulmonary capillaries may damage the endothelial lining of the capillaries causing them to lose their selective permeability; hence, water, electrolyte and red blood cell extravasate into the interstitial lining. Fluid also penetrates the alveoli to cause pulmonary edema with impairment of gaseous exchange. Subsequent build-up of carbon IV oxide leads to increase in its partial pressure in the pulmonary capillaries (causing hypoventilation). There is a resultant shift of the hemoglobin–oxygen dissociation curve to the left and oxygen availability to both the mother and the fetus is compromised.

EDEMA

Major causes of edema, including heart failure, loss of plasma protein and decreased renal excretion of salt and water, are all pathognomonic of the generalized edema of severe preeclampsia. Failure of the heart to pump blood raises venous and capillary pressures causing increased capillary hydrostatic pressure that accounts for fluid extravasation. Exacerbation of the edematous condition may occur following the activation of renin-angiotensin-aldosterone system by renal hypoperfusion. Following renal damage, loss of plasma protein, particularly albumin causes loss of colloidal osmotic pressure that result in accumulation of fluid in the tissue spaces. Edema in the brain also occurs by the same process as in the lungs and may be followed by hyper-reflexia and central nervous system irritability, increased intracranial pressure, and coma. Increased intracranial pressure is the leading cause of death in severe preeclampsia.

ECLAMPSIA

Eclampsia is a rare onset of grand mal seizures occurring in less than 1 percent of preeclamptic women. About 40, 20, and 40 percent of eclampsia occur antepartum, intrapartum and postpartum respectively. Eclampsia is third largest cause

of maternal death after cerebral hemorrhage and embolism. The mortality rate is as high as 14% in developing countries while perinatal death rate in recent series ranged from 5.6% to 11.8%. This high perinatal death rate is related to prematurity, abruptio placentae, and severe fetal growth restriction.³² Baker⁴ suggests that the condition should be suspected in all manner of convulsion during pregnancy until proven otherwise. Govan³³ also hinted that eclamptic lesion may result owing to increased coagulability of blood, hypertension, and increased permeability of blood vessels. Increased cerebrovascular resistance is the most likely cause of cerebral hemorrhage that is strongly associated with maternal mortalities in preeclampsia. Some severe preeclamptic patients may have cerebral edema, which manifests as headache, confusion, altered consciousness and blurred vision that herald eclamptic fits.

The diagnosis of eclampsia is usually associated with proteinuria (at least 1+ on dipstick) and other clinical symptoms (persistent occipital or frontal headaches, blurred vision, photophobia, epigastric and/or right upper quadrant pain, and altered mental status) that may occur before or after the onset of convulsions.³² Abnormal weight gain (with or without clinical edema) in excess of 2 pounds per week during the third trimester might be the first sign before the onset of eclampsia. After the convulsion, the blood pressure transiently normalizes while the proteinuria persists. Because of impending fetal and maternal risks in continued pregnancy, delivery is the treatment of choice particularly if induced after the 28th week.¹⁸ Delivery before 34th week would demand administration of steroids to improve fetal lung maturity, and to decrease neonatal complications.

HELLP SYNDROME

This is a life threatening obstetric condition, which is an acronym for hemolysis, elevated liver enzyme and low platelet count. It is a multisystem disease manifesting with epigastric pain (this denoting hepatic involvements), which radiates through the right upper quadrant and back. About 0.6-10% of pregnancies³⁴ are confronted with HELLP syndrome; with its associated morbidity and mortality rates as high as 25 percent.³⁵ The condition occurs any time as from late pregnancy to after delivery and is characterized by headache, blurred vision, malaise, nausea, vomiting, edema, and hematoma resulting from ruptured hepatic capsule. The exact etiology is unknown but decreased prostacyclin synthesis with generalized activation of coagulation cascade that consumes platelets remains an underlying problem that causes fibrins to form cross-linked networks capable of

occluding small hepatic vessels. This leads to microangiopathic hemolytic anemia; red blood cells being lysed as they are forced through fibrins meshwork. Periportal necrosis follows as downstream hepatocytes suffer ischemia, while disseminated intravascular coagulation may ensue giving way to paradoxical bleeding that may warrant emergency surgery.²⁰ There is also a finding of serum aspartate transaminase level of more than 70U/L. Pregnancies complicated by HELLP syndrome are associated with poor maternal and fetal outcome. The syndrome increases maternal risks of developing acute renal failure, pulmonary edema, pleural effusion, hepatic rupture, abruptio placentae, and disseminated intravascular coagulopathy.

FETAL CONSEQUENCES

INTRAUTERINE GROWTH RESTRICTION (IUGR)

Abnormal placental formation and other conditions like congenital anomalies, chromosomal abnormalities, and fetal infections are major factors believed to be accountable for fetal growth restriction,¹³ which leads to increased fetal or neonatal morbidity and mortality. It is defined as failure of fetus to achieve its genetic growth potential resulting due to inability of a defective placenta to meet fetal need. Subsequently, impaired gaseous exchange and nutrient availability leads to fetal asymmetrical growth restriction with relative sparing of the brain.³⁶ There is impaired urine production and oligohydramnios in fetus due to vasoconstriction in fetal kidney. Fetal hypoxia is followed by acidemia, which has been suggested to cause intrauterine death in fetus of preeclamptic women.³⁶ Also, Ounsted and

Ounsted³⁷ opined that fetal growth is dependent on an optimal intrauterine environment especially in relation to the placento-fetal delivery of oxygen and nutrients. Conditions that may aggravate intrauterine growth restriction include maternal under-nutrition, anorexia, low maternal oxygen saturation, increased carboxyhemoglobin (as seen in smokers of heroin, marijuana, and tobacco), and alcohol consumption. The condition can be detected by ultrasonographic assessment of fetal growth, as well as the gestational age.^{38,39} Roberts and Cooper² concluded that the pathophysiology of IUGR is correlated with failure of extravillous trophoblast invasion.

Figure 1

Cerebrovascular accidents
Hemorrhage
Ruptured aneurysm or malformation
Arterial embolism or thrombosis
Cerebral venous thrombosis
Hypoxic ischemic encephalopathy
Angiomas
Hypertensive encephalopathy
Seizure disorder
Previously undiagnosed brain tumors
Metastatic gestational trophoblastic disease
Metabolic diseases
Hypoglycemia, hyponatremia
Reversible posterior leukoencephalopathy syndrome
Thrombophilia
Thrombotic thrombocytopenic purpura
Postdural puncture syndrome
Cerebral vasculitis

Adapted from Sibai³²

Figure 2

Table 2 Factors associated with IUGR

Medical complications
Preeclampsia
Acute or chronic hypertension
Antepartum hemorrhage
Severe chronic disease
Severe chronic infections
Systemic lupus erythematosus
Antiphospholipid syndrome
Anemia
Malignancy
Abnormalities of the uterus
Uterine fibroids
Maternal social conditions
Malnutrition
Low pregnancy BMI
Low maternal weight gain
Delivery at age ≤ 16 or ≥ 35 yr
Low socioeconomic status
Drug use
Smoking
Alcohol
Illicit drugs
Fetal problems
Multiple births
Malformation
Chromosomal abnormalities
Inborn errors of metabolism
Intrauterine infections
Environmental problems
High altitude
Toxic substances
Abnormalities of the placenta
Reduced blood flow
Reduced area for exchange
Infarcts
Hematomas
Partial abruption
Bryan and Hindmarsh ¹³

OLIGOHYDRAMNIOS

This condition may be caused by renal agenesis, uteroplacental insufficiency and rupture of amnion, which results to chronic leakage of the amniotic fluid. Fetal compression follows, resulting in deformities like flattened facies, dislocated hips, positional abnormalities of hands and feet, pulmonary hypoplasia and amnion nodosum.³⁶ However, limb deformities less commonly occur in oligohydramnios caused by uteroplacental insufficiency.⁴

CLINICAL INTERVENTION IN PREECLAMPSIA

Despite extensive studies carried out to elucidate its etiologic and pathophysiological pattern, no blood test has been found to be precisely diagnostic for preeclampsia, even the previously employed renal biopsy. Nonetheless, diagnosis can be made in patients who already present the clinical features. Findings like proteinuria > 0.3g in a 24-hour; hypoalbuminemia (reference range, 3.5-5.2g/dl); hyperuricemia ; serum creatinine >70µmol/l;²⁰ prolonged prothrombin time; thrombocytopenia (platelet count less than 100x10⁹/L); increased liver enzymes: alkaline phosphatase, aspartate transaminase level twice higher than the upper normal value;²⁰ hyperbilirubinemia (particularly the unconjugated fraction); increased Erythrocyte Sedimentation Rate,²⁸ oliguria, as well as specific symptoms like visual disturbances, grand mal seizures, epigastric pain, headache with progressively deteriorating liver function in a hypertensive pregnant woman supports diagnosis of preeclampsia.²⁷ The progression of preeclampsia is relentless and no intervention, except delivery, has been found to be effective. Hence, different investigators recommend proper prenatal care, early detection of the disorder, careful monitoring and appropriate management as crucial elements in the prevention of preeclampsia-related mortalities. Management involves careful maternal observation and measurement of fetoplacental function to balance maternal risks of continuing pregnancy with fetal risks of extrauterine existence.⁴⁰

Figure 3

Table 3 Diagnostic criteria for classifying preeclampsia

Mild Preeclampsia	Severe Preeclampsia
Blood pressure ≥ 140/90mmHg Proteinuria ≥ 0.3g in 24hour urine	<ul style="list-style-type: none"> • Blood pressure ≥ 160/110mmHg measured on at least two separate occasions of at least 6 hours apart in a patient at bed rest. • Proteinuria ≥ 0.5g in a 24-hour urine or 1-2+ in a random urine specimen on dipstick. • Oliguria (<400ml urine per day) • Cerebral disturbance • Epigastric pain • Pulmonary edema • Impaired liver function • Thrombocytopenia (platelet count < 100 x 10⁹/L) Zamorski and Green ¹⁸

Although there is no clear-cut treatment option for preeclampsia, Zhou et al²² showed that Losartan or an antibody-blocking epitope peptide prevented sFlt-1 secretion and as such may thus be therapeutically effective in the treatment of preeclampsia, while Germain et al³¹ observed that L-arginine administration may be beneficial against loss of endothelial vasodilation.

CONCLUSION/RECOMMENDATIONS

Maternal and fetal morbidity and mortality are serious concerns in preeclampsia and are attributable to poor management. Nonetheless, it should be noted that while no generally accepted preventive measures exist, proper fetal and maternal monitoring can help mitigate the progression of preeclampsia to fatal symptoms.¹⁸ It is worthy to state that government, through the health ministry can help reduce the burden of preeclampsia and its sequela if the cost of antenatal services especially in countries with low per capita income is subsidized as many more patients will take refuge in the clinics should unusual symptoms be noticed.

Efforts should be intensified to educate pregnant women in developing nations on the need for antenatal visitation and routine check-up. Thus, during antenatal visitation, pregnant women should be educated on the risks associated with gestation especially for primigravida. Patients on antenatal care should be enjoined to strictly adhere to guidelines issued to them on admission, and as well report observations that are not usual in them. Reporting of symptoms that are consistent with preeclampsia should be done without delay and must be seriously taken. Past medical, obstetric and gynaecological history should be taken during antenatal visitation to help identify high-risk patients, while such categories of patients should have their blood pressure closely monitored, and elevation above 140/90 mm Hg after 20th week treated as an obstetric emergency. The finding of

protein in the urine of such patient should also not be overlooked. Patients who have asymptomatic proteinuria at booking should be investigated for underlying renal disease. For mild preeclampsia, bed rest, a balanced diet, and antihypertensive treatment are recommended while in severe preeclampsia, delivery should be indicated without delay. Establishment of fetal well-being by continuous fetal heart monitoring and ultrasound examination is crucial.

Following delivery (in case of its indication), maternal condition should be monitored to check deterioration, and to ensure that the normal healthy status is restored after 6 weeks of delivery. Whenever possible, delivery should be hinged on whether the fetus will survive better in utero or when delivered, while also assessing maternal ability to carry pregnancy to term.

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Author Information

Zeribe Chike Nwosu, B.MLS

Chemical Pathology Unit, Ebonyi State University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria

Maxwell Omabe

> Molecular Medicine Research Group, School of Biomedical Sciences, Faculty of Health and Life Science. University of Ulster, UK