Overview

Hypertension complicates 7–10% of pregnancies, of which 70% are due to gestational hypertension/preeclampsia and 30% are due to chronic essential hypertension. The rate of hypertensive disorders in nulliparous women approaches 29%.

Risk factors include:
- nulliparity
- obesity (BMI greater than 30 kg/m²)
- multiple gestation
- family history of preeclampsia or eclampsia
- preexisting hypertension or renal disease
- previous preeclampsia or eclampsia
- diabetes mellitus or gestational diabetes
- Artificial conception
- Advanced maternal age (greater than 40 years)
- nonimmune hydrops
- antiphospholipid antibody syndrome or autoimmune disease
- molar or partial molar pregnancy.

Preeclampsia rarely develops before 20 weeks of gestation. In this early stage, rule out underlying renal disease, molar pregnancy, and other medical disorders.

Pathophysiology

Preeclampsia is a disorder of unknown etiology that is peculiar to human pregnancy. The pathophysiological abnormalities in preeclampsia include
inadequate maternal vascular response to placentation, endothelial dysfunction, abnormal angiogenesis, and exaggerated inflammatory response with resultant generalized vasospasm, activation of platelets and abnormal hemostasis. These abnormalities result in pathophysiological vascular lesions in peripheral vessels and utero-placental vascular beds, as well as in various organ systems, such as the kidneys, liver, lungs and brain. Consequently, these pregnancies, particularly those with preeclampsia and severe features, are associated with increased maternal and perinatal mortality and morbidity due to reduced utero-placental blood flow, abruptio placentae and preterm delivery. Recent evidence indicates that preeclampsia is an endothelial disorder. Thus, in some patients the disease may manifest itself in the form of either a capillary leak, fetal growth restriction, reduced amniotic fluid, or a spectrum of abnormal laboratory tests with multiple organ dysfunction (Fig. 39.1).

**Diagnosis**

Recently, the diagnosis of preeclampsia and its subtypes have been expanded and revised by the ACOG Task Force on Hypertension in Pregnancy:
Preeclampsia

**Gestational hypertension**
- Systolic blood pressure (BP) at least 140 mmHg, but less than 160 mmHg or
- Diastolic BP at least 90 mmHg, but less than 110 mmHg
- The above pressures should be observed on at least two occasions 4 hours apart, no more than 7 days apart
- BP readings can vary with the type of equipment used, cuff size, position of the arm, position of the patient, duration of rest period, obesity, smoking, anxiety, and the Korotkoff sound used to assess diastolic BP. Only Korotkoff sound V should be used to establish diastolic BP.

**Severe hypertension**
- Sustained elevations in systolic BP to at least 160 mmHg and/or in diastolic BP to at least 110 mmHg for at least 4 hours or once if patient is receiving antihypertensive medications.

**Proteinuria**
- 0.3 g or more in a 24-hour urine collection or protein: creatinine ratio 0.3 mg/mg or more.
- Protein excretion in the urine increases in normal pregnancy from approximately 5 mg/dL in the first and second trimesters to 15 mg/dL in the third trimester. These low levels are not detected by dipstick. The concentration of urinary protein is influenced by contamination with vaginal secretions, blood, bacteria, or amniotic fluid. It also varies with urine-specific gravity and pH, exercise and posture.
- Proteinuria usually appears after hypertension in the course of the disease process, but in some women it could appear before hypertension.

**Edema**
- Excessive weight gain greater than 4 lb/week (greater than 1.8 kg/week) in the second or third trimester may be the first sign of the potential development of preeclampsia.
- 39% of eclamptic patients do not have edema.

**Preeclampsia**
The Task Force classifies preeclampsia as preeclampsia with or without severe features. The term mild preeclampsia has been removed and should not be used. Preeclampsia is defined as gestational hypertension plus any of the following:
- Proteinuria as defined above or
- Any of the findings listed below for preeclampsia with severe features.
**Preeclampsia with severe features**

- Systolic BP at least 160 mmHg or diastolic BP at least 110 mmHg on two occasions at least 4 hours apart while the patient is on bed rest, or once if the patient receives antihypertensive therapy before that. It is recommended that severe BP values that are sustained for more than 30 minutes require immediate treatment.
- New onset persistent cerebral symptoms (headaches) or visual disturbances.
- Impaired liver function as indicated by abnormally elevated liver enzymes (twice normal levels), severe persistent right upper quadrant or epigasric pain unresponsive to medications and not accounted by alternative diagnosis, or both.
- Pulmonary edema.
- Thrombocytopenia (platelet count less than 100,000/\(\mu\)L).
- Progressive renal insufficiency (serum creatinine greater than 1.1 mg/dL).
- The amount of proteinuria, presence of oliguria, and fetal growth restriction have been removed from the diagnosis of severe disease.

**Management**

Delivery is the only available cure for preeclampsia. The ultimate goals of any management plan must be the safety of the mother first and then delivery of a live mature newborn that will not require intensive and prolonged neonatal care. The decision between immediate delivery and expectant management will depend on one or more of the following: maternal and fetal conditions at the time of evaluation, fetal gestational age, presence of labor or rupture of membranes, severity of the disease process, and maternal desire.

**Mild hypertension or preeclampsia**

Figure 39.2 provides a management algorithm for mild hypertension or preeclampsia.

**37 weeks or more**

- At 37 weeks or more of gestation, induction of labor is indicated. Induce also earlier for any signs of maternal-fetal distress (suspected abruption, confirmed fetal growth restriction, labor or rupture of membranes).
- Prostaglandins can be used for cervical ripening in those with Bishop score less than 6.
Management of mild HTN or preeclampsia

**Maternal and fetal evaluation**

- 37 weeks of gestation or greater
- 34 weeks of gestation or greater
  - Labor, PPROM
  - Suspected abruption
  - Abnormal M/F testing

**Yes**

- Delivery

**No**

- Inpatient/outpatient
- Maternal/fetal testing

**Figure 39.2** Recommended management of mild gestational hypertension or preeclampsia.

**Less than 37 weeks**

- In all patients, the maternal and fetal conditions should be evaluated.
- Outpatient management is possible if the patient’s systolic BP is less than 155 mmHg and/or diastolic BP is less than 105 mmHg, with a platelet count more than 100,000/mL, normal liver enzymes and reassuring fetal testing. The patient should also have no subjective symptoms, and should be compliant and reliable.
- Whether the patient is in the hospital or being managed at home, the following should be observed:
  - Salt restriction, diuretics, antihypertensive drugs, and sedatives are not used.
  - Patient should have relative rest, twice weekly evaluation of protein (mild gestational hypertension only), twice weekly BP monitoring, 1–2 times per week fetal testing, and laboratory evaluation of hematocrit and platelets, and liver function tests, serum creatinine once a week. Patient should be educated about preeclampsia warning signs, such as headache, visual disturbances, epigastric pain, nausea and vomiting, and shortness of breath. Patient should be instructed about daily kick counts and labor signs or vaginal bleeding.
  - Fetal testing should consist of at least weekly nonstress testing (NST) for gestational hypertension only, and twice weekly NST and measurement of amniotic fluid volume in those with preeclampsia. In addition, assessment of fetal growth by ultrasonography every 3 weeks. Testing is considered nonreassuring if:
    - NST is nonreactive with abnormal fetal biophysical profile
- NST shows repetitive late deceleration, repetitive variable decelerations, fetal tachycardia or prolonged deceleration.
- Oligohydramnios is present (AFI persistently less than 5.0 cm).
- Estimated fetal weight is less than 5th percentile for gestational age.
- Prompt hospitalization is needed for disease progression: acute severe hypertension, development of new symptoms, outpatient management unsatisfactory for the specific patient, or abnormal fetal testing.

**Preeclampsia with severe features**

Figure 39.3 provides a management algorithm for preeclampsia with severe features.

- Beyond 34 weeks: induction and delivery. There is no need for assessment of fetal lung maturity.
- 33 to 34 weeks: steroids for fetal lung maturity. Delivery after 48 hours.
- Hemolysis, elevated liver enzymes, low platelets (HELLP) syndrome: steroids for fetal lung maturity, then deliver after second dose.
- 23 weeks 0 days to 32 weeks 6 days: expectant management and steroids.
- Less than 23 weeks: offer termination with prostaglandin E₂ (PGE₂) vaginal suppository, laminaria and oxytocin (Pitocin), or dilatation and

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**Severe preeclampsia < 34 weeks**

- Admit to L&D 24–48 hours
- Corticosteroids, MgSO4 prophylaxis, antihypertensives
- Ultrasound, FHR monitoring, symptoms, laboratory tests

Are there additional complications?
- Persistent symptoms
- HELLP/partial HELLP syndrome
- FGR (<5th percentile)
- REDF (umbilical artery)
- Labor/PROM, 33⁵/₇–33⁶/₇

Contraindications to continued expectant management?
- Eclampsia
- Pulmonary edema
- DIC, ARF
- Less than 23⁵/₇ weeks
- Abnormal fetal testing
- Abruptio placentae

Offer continued expectant management
- Inpatient only, D/C MgSO4
- Daily maternal/fetal testing, sx, BP, lab

Delivery

Contraindications to continued expectant management?
- Eclampsia
- Pulmonary edema
- DIC, ARF
- Less than 23⁵/₇ weeks
- Abnormal fetal testing
- Abruptio placentae

Figure 39.3  Recommended management of preeclampsia with severe features.
evacuation. Overall perinatal survival without termination is 6.7%. If patient does not elect to terminate, manage expectantly, but counsel about maternal risks and poor perinatal outcome.

**Conservative management of preeclampsia with severe features**

In a tertiary care center:
- Initial intravenous magnesium sulfate for 24 hours.
- Antihypertensives: intravenous boluses, then shift to oral administration, nifedipine, labetalol
  - Hydralazine: 5 to 10 mg boluses every 20 to 30 minutes (maximum dose 25 mg)
  - Labetalol: 20, 40, 80 mg boluses (maximum dose 220 mg), then 200 mg orally every 8 hours (maximum 800 mg every 8 hours)
  - Nifedipine: 10 to 20 mg rapid acting orally every 20–30 minutes (maximum 50 mg), then 10–20 mg every 4–6 hours (maximum 120 mg/day). Oral long-acting nifedipine can also be used.
- Aim: Diastolic BP 90 to 100 mmHg and systolic BP 140 to 150 mmHg. Avoid normal BP because of the risk of decreased utero-placental perfusion. Adequate therapeutic response is expected in 12 hours.
- Give steroids for immature lungs and attempt to delay delivery at least for steroid benefit (48 hours).
- Daily fetal–maternal testing.

The majority of patients with severe preeclampsia managed conservatively will require delivery within 2 weeks of admission. Indications for delivery of these patients include the following:
- Maternal indications: thrombocytopenia or HELLP, disseminated intravascular coagulation (DIC), pulmonary edema, renal failure, eclampsia, uncontrolled severe hypertension, suspected abruptio placentae, labor or rupture of membranes, severe ascites; warning signs: persistent and severe headache, blurring of vision, epigastric pain.
- Fetal indications: Nonreassuring fetal heart rate tracing irrespective of gestational age or lung maturity, persistent severe oligohydramnios (largest vertical pocket 2 cm), severe fetal growth restriction (less than 5th percentile) with abnormal umbilical artery Doppler study, or gestational age greater than 34 weeks achieved.

**HELLP**
- Hemolysis: abnormal peripheral blood smear; increased bilirubin 1.2 mg/dL or higher; low haptoglobin levels.
- Elevated liver enzymes: increased lactic dehydrogenase or SGOT greater than twice the upper limit of normal.
- Low platelets: less than 100,000/μL.
- Occurs in 10% to 20% of preeclamptic patients with severe features.
- More frequent in whites and multiparas.
- Complaints of nausea and vomiting (50%), malaise of a few days’ duration (90%), epigastric or right upper quadrant pain (65%), or swelling. Others will have vague abdominal pain, flank or shoulder pain, jaundice, hematuria, gastrointestinal bleeding, or gum bleeding.
- Onset antepartum in 70% of the cases and postpartum in 30% of the cases.
- In the postpartum period, the time of onset of the clinical manifestations may range from a few hours to one week, with the majority developing within 48 hours.
- Hypertension may be absent in 20% and mild in 30% of the cases.
- Proteinuria may be absent in 5% of cases.
- Temporary management of HELLP for 48 hours is only possible in the absence of DIC, particularly for benefit of corticosteroid administration.

**Intrapartum management of preeclampsia with severe features and HELLP**

- The first priority is to assess and stabilize maternal condition and then to evaluate fetal well-being. Finally, a decision must be made as to whether immediate delivery is indicated (Table 39.1).
- Intravenous magnesium sulfate: 4–6 g loading dose over 20 minutes (6 g in 100 mL 5% dextrose in water) followed by the maintenance dose of 2 g/h during labor and for 12 to 24 hours postpartum (40 g in 1 L lactated Ringer’s solution at 50 mL/h or 20 g in 1 L lactated Ringer’s solution at 100 mL/h). Remember that the risk of eclamptic convulsion in those with severe disease is less than 2%. For preeclampsia without severe features, the risk is less than 0.5%. For these women, it is appropriate not to give magnesium sulfate, but they should still receive close monitoring of BP and maternal symptoms to identify those that may progress to severe disease.
- For HELLP patients, type and cross-match with 2 units of blood. Have platelets available if the platelet count is below 50,000.
- Accurate measurement of fluid input and output: Foley catheter, restrict total intake to 100 mL/h to avoid pulmonary edema. If pulmonary edema is suspected, give 40 mg IV Lasix and obtain chest X-ray, and maternal echocardiography if needed.
- Frequent monitoring of pulse, BP, urine output, and respiration.
- Monitor for signs of magnesium toxicity and have a magnesium level drawn if needed; be ready to counteract magnesium toxicity with 10 mL of 10% calcium gluconate intravenously, and intubation if the patient develops respiratory arrest. Be ready to deal with convulsions.
- Continuous fetal monitoring.
Table 39.1  Management outline of antepartum HELLP syndrome

1  Assess and stabilize maternal condition
   a. Antiseizure prophylaxis with magnesium sulfate
   b. Treatment of severe hypertension
   c. Transfer to tertiary care center if appropriate
   d. Computed tomography or ultrasound of the abdomen if subcapsular hematoma of the liver is suspected

2  Evaluate fetal well-being
   a. 34 weeks of gestation or more→ delivery
   b. 24–34 weeks of gestation → steroids → delivery in 24–48 hours

Deliver if abnormal fetal assessment
Deliver if progressive deterioration in maternal condition

- Oxytocin induction and allow normal vaginal delivery for favorable cervix or gestational age of 30 weeks or beyond. If the cervix is unripe and gestational age is less than 30 weeks, consider elective cesarean delivery or cervical ripening with PGE₂.
- Anesthesia: intermittent small doses of Stadol IVP, 1 to 2 mg. Epidural anesthesia is preferred to general anesthesia in case of abdominal delivery if personnel skilled in obstetric anesthesia are available. Pudendal block and epidural are not advisable in HELLP patients as it might result in hematoma formation.
- If thrombocytopenia is present, it should be corrected before surgery: Transfuse with 6–10 units of platelets in all patients with a platelet count less than 40,000/μL.
- In HELLP patients to minimize the risk of hematoma formation: the bladder flap should be left open, a subfascial drain is used, and the wound is left open. The wounds can be successfully closed within 72 hours after drain removal.

Postpartum management

- Adequate observation of the mother in the recovery room for 12 to 24 hours under magnesium sulfate coverage. Remember that 25–30% of the eclampsia cases and 30% of the HELLP cases occur in the postpartum period. In addition, some women will develop new onset hypertension or preeclampsia for the first time postpartum. The majority will occur at 3–7 days postpartum. Therefore, patients with hypertensive disorders should have a BP recording at 3 days postpartum and again at 5–7 days after discharge.
- Most patients will show evidence of resolution of the disease process within 24 hours after delivery. Some, especially those with severe disease
in the midtrimester, HELLP, or eclampsia, require close monitoring for 2–3 days.

- By the time of discharge, most patients will be normotensive. If hypertension persists, antihypertensive medications are prescribed for 1 week, after which the patient is reevaluated. In addition, all patients should be given written instruction about signs and symptoms to report as well as a phone number to call in case of development of new symptoms or severe hypertension. Follow-up BP recordings can be done at home or in an office. Patients with preeclampsia with severe features and those with superimposed preeclampsia should not be prescribed nonsteroidal anti-inflammatory agents for pain or ergot derivatives.

**Complications of preeclampsia and HELLP**

Complications include abruptio placentae, pulmonary edema, acute renal failure, liver hematoma with possible rupture, postpartum hemorrhage, wound or intraabdominal hematomas, DIC and multiorgan failure, including liver, kidneys and lungs (adult respiratory distress syndrome). Neurologic-like eclampsia, hypertensive encephalopathy, ischemia, infarcts, edema and hemorrhage can also occur, as can cardiorespiratory arrest.

**Follow up and maternal counseling**

Women who develop preeclampsia in their first pregnancy are at increased risk (20%) for development of preeclampsia in subsequent pregnancies. The risk of preeclampsia in the sister of a patient with preeclampsia is 14%. With severe disease in a first pregnancy, the risk of recurrence is about 30%. With severe disease in the second trimester, the risk of recurrent preeclampsia is 50%. In 21% of cases, the disease also occurs in the second trimester. HELLP recurs in about 5% of cases.

There is increased risk of chronic hypertension and undiagnosed renal disease. This is especially true in patients with two episodes of preeclampsia in the second trimester. These patients should have adequate medical evaluation postpartum. There is also increased risk of fetal growth restriction in a subsequent pregnancy. Finally, women who develop hypertensive disorders in pregnancy are at increased risk for cardiovascular disease and metabolic syndrome later in life. Therefore, they should receive close monitoring for these complications.
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Suggested reading