Hypertension in Pregnancy

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1. Prevention

Do not recommend routine prevention for pregnancy-related hypertension.  

1.1 Use low-dose aspirin in women with moderate or high risk for preeclampsia for prevention of preeclampsia. Do not use aspirin routinely to prevent pregnancy-related hypertension.

Recommendations

- Prescribe low-dose aspirin only in women with high risk for preeclampsia, such as those with
  - Preexisting essential hypertension
  - History of preeclampsia, especially if it was accompanied by preterm delivery
  - Chronic medical conditions, such as kidney disease or diabetes
- In women who are candidates for aspirin therapy,
  - Treat with 75 or 81 mg daily
  - Begin therapy at the end of the first trimester
- Recommend prenatal multivitamins for all pregnant patients.
- Recommend calcium supplementation only in women with low calcium dietary intake for the prevention of preeclampsia.
- Note that the following have not been shown to prevent hypertensive disorders of pregnancy:
  - Salt restriction
  - Magnesium supplementation
  - Treatment with antihypertensive agents (to reduce the risk for preeclampsia)
  - The use of high-dose vitamins C and E
- See module Preeclampsia.

Evidence

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended that women with history of preeclampsia and preterm delivery or of preeclampsia in multiple prior pregnancies be treated with daily low-dose aspirin 60 to 80 mg) beginning late in the first trimester.
- A 2010 NICE guideline recommended that pregnant women at high risk for preeclampsia take low-dose aspirin (75 mg) daily beginning during week 12 of pregnancy. Women at high risk were defined as those with CKD, hypertension during a previous pregnancy, autoimmune disease, diabetes, or chronic hypertension.
- A 2011 systematic review of supplementation with vitamin C or vitamin E for the prevention of preeclampsia and other adverse maternal outcomes included nine randomized, controlled trials with 19,810 participants. The risk for preeclampsia was similar in vitamin and control groups (RR, 1.00 [CI, 0.92 to 1.09]); the risk for gestational hypertension was increased in vitamin groups (RR, 1.11 [CI, 1.05 to 1.17]), and the risk for placental abruption was decreased (RR, 0.63 [CI, 0.43 to 0.94]) (1).
- A 2010 Cochrane review of calcium supplementation for the prevention of preeclampsia included 13 studies with 15,730 participants. Overall, the risk for hypertension (RR, 0.65 [CI, 0.53 to 0.81]) and preeclampsia (RR, 0.45 [CI, 0.31 to 0.65]) were lower in women receiving calcium, with more benefit among higher-risk women. Calcium also reduced the composite of maternal death or serious morbidity (RR, 0.80 [CI, 0.65 to 0.97]) (2).
• A 2007 individual patient meta-analysis of antiplatelet agents for the primary prevention of preeclampsia included 32,317 patients from 31 randomized trials. Treatment with antiplatelet agents compared with control treatment resulted in a lower risk for preeclampsia (RR, 0.90 [CI, 0.84 to 0.97]), for birth before 34 weeks’ gestation (RR, 0.90 [CI, 0.83 to 0.98]), and for having a pregnancy with a serious adverse outcome (RR, 0.90 [CI, 0.85 to 0.96]). Antiplatelet agents had no significant effect on the risk for death of the fetus or baby, having a small-for-gestational-age infant, or bleeding events for either the women or their babies. No particular subgroup of women was substantially more or less likely to benefit from antiplatelet agents than any other (3).

• A 2007 Cochrane review of antiplatelet agents to prevent preeclampsia included 59 trials involving 37,560 women. Women receiving antiplatelet agents had a lower risk for preeclampsia (RR, 0.83 [CI, 0.77 to 0.89]) compared with control treatment (NNT, 72). Women receiving antiplatelet agents had lower risks for preterm birth (RR, 0.92 [CI, 0.88 to 0.97]), fetal or neonatal deaths (RR, 0.86 [CI, 0.76 to 0.98]), and small-for-gestational-age infants (RR, 0.90 [CI, 0.83 to 0.98]). No difference was seen for placental abruption, eclampsia, or maternal death (4).

• A 2013 randomized trial compared aspirin with placebo in 121 pregnant women with reduced uterine artery blood flow. Rates of preeclampsia were similar in the two groups (RR with aspirin, 0.7 [CI, 0.3 to 1.7]). A systematic review and updated meta-analysis including the new data found that aspirin reduced the risk for preeclampsia (RR, 0.6 [CI, 0.4 to 0.8]) (5).

• A 2001 narrative review discussed current knowledge with respect to primary, secondary, and tertiary prevention of preeclampsia (6).

Rationale
• Antiplatelet agents have been associated with a decreased risk for preeclampsia.
• Calcium supplementation in pregnancy for women with low calcium intake (<600 mg/day) has been associated with reduction in risk for preeclampsia and preterm birth.
2. Screening

Regularly screen all women of childbearing age for hypertension.

2.1 Measure BP in all pregnant women at each visit.

Recommendations
- Measure BP at each prenatal visit.

Evidence
- A 2010 NICE guideline on antenatal care recommended checking BP at every antenatal visit in order to screen for preeclampsia.
- A cross-sectional study used data from the U.S. Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project to evaluate the trends in hypertensive disorders in pregnancy and maternal complications of pregnancy. The prevalence of hypertensive disorders in pregnancy increased from 67.2 per 1000 deliveries in 1998 to 81.4 per 1000 deliveries in 2006. Hospitalizations in women with hypertensive disorders were associated with more complications than those in normotensive women (7).
- Every study that has examined the risk for hypertension in pregnancy has shown an increased risk for perinatal mortality. In a 1999 report, this collected data showed the random-effects summary OR for these studies to be 3.4 (CI, 3.0 to 3.7) (8).
- Hypertensive disorders of pregnancy ranked third as a cause of maternal mortality in the U.S. in a 2003 review of data from the Centers for Disease Control and Prevention (9).

Rationale
- Hypertensive disorders are common in pregnancy and occur in about 5% to 8% of pregnancies in the U.S.
- Preeclampsia occurs in 20% of women with chronic hypertension. Moderate to severe hypertension is associated with an increased risk for abruptio placenta, infants who are small for their gestational age, and perinatal mortality, even if not complicated by preeclampsia.
- Hypertensive disease is a major cause of maternal mortality in the U.S.

2.2 Screen all women after 20 weeks' gestation for preeclampsia, especially those at increased risk for the disease, by following BP and checking for proteinuria and edema.

Recommendations
- Monitor BP and look for symptoms and signs of preeclampsia in all women after 20 weeks' gestation.
  - Perform urine dipstick to look for proteinuria
  - Check for edema
- Maintain a higher level of suspicion for preeclampsia in patients whose pregnancy is complicated by the presence of any of the following:
  - Chronic hypertension
  - Preeclampsia in a previous pregnancy (particularly if it occurred before 34 weeks' gestation)
  - Obesity
  - Thrombophilia
  - Chronic renal disease
  - Systemic lupus erythematosus
• Type 1 diabetes
• Multiple gestation (e.g., twins, triplets)
• Maternal age younger than 18 or older than 35
• Grand multiparity
• Hydrops fetalis
• Molar pregnancies
• See module Preeclampsia.

Evidence

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy noted the risk factors for preeclampsia and recommended using only the patient's history to assess the risk for preeclampsia.
- A 2010 NICE guideline on antenatal care recommended checking BP at every antenatal visit in order to screen for preeclampsia.
- A 2011 systematic review of adverse pregnancy outcomes in women with asthma included 40 cohort studies. Maternal asthma was associated with an increased risk for preeclampsia (RR, 1.54 [CI, 1.32 to 1.81]) (10).
- A 2008 systematic review of the accuracy of BP measurements for predicting preeclampsia included 34 studies with 60,599 participants. A second-trimester mean arterial pressure of 90 mm Hg or more showed a positive LR of 3.5 (CI, 2.0 to 5.0) and a negative LR of 0.46 (CI, 0.16 to 0.75). In women deemed to be at high risk, a diastolic BP of ≥75 mm Hg at 13 to 20 weeks' gestation best predicted preeclampsia (positive LR, 2.8 [CI, 1.8 to 3.6]; negative LR, 0.39 [CI, 0.18 to 0.71]). When BP was measured in the first or second trimester of pregnancy, the mean arterial pressure was a better predictor for preeclampsia than systolic BP, diastolic BP, or an increase of BP (11).
- A 2008 systematic review of the relationship between maternal infection and preeclampsia included 49 observational studies. The risk for preeclampsia was increased in pregnant women with urinary tract infection (pooled OR, 1.57 [CI, 1.45 to 1.70]) and periodontal disease (pooled OR, 1.76 [CI, 1.43 to 2.18]) (12).
- A 2005 systematic review of risk factors for preeclampsia included 52 cohort and case-control studies. The risk for preeclampsia was increased in women with a previous history of preeclampsia (RR, 7.19 [CI, 5.85 to 8.83]), antiphospholipid antibodies (RR, 9.72 [CI, 4.34 to 21.75]), preexisting diabetes (RR, 3.56 [CI, 2.54 to 4.99]), multiple (twin) pregnancy (RR, 29.3 [CI, 2.04 to 4.21]), nulliparity (RR, 2.91 [CI, 1.28 to 6.61]), family history (RR, 2.90 [CI, 1.70 to 4.93]), raised BP (diastolic ≥80 mm Hg) at booking (RR, 1.38 [CI, 1.01 to 1.87]), raised BMI before pregnancy (RR, 2.47 [CI, 1.66 to 3.67]) or at booking (RR, 1.55 [CI, 1.28 to 1.88]), or maternal age 40 years or older (RR, 1.96 [CI, 1.34 to 2.87], for multiparous women). Individual studies showed that risk was also increased with an interval of 10 years or more since a previous pregnancy, autoimmune disease, renal disease, and chronic hypertension (13).
- A 2005 systematic review of genetic thrombophilias and preeclampsia included 31 case-control studies with over 7000 participants. Factor V Leiden was associated with preeclampsia (OR, 1.81 [CI, 1.14 to 2.87]), but methylene tetrahydrofolate polymorphism (OR, 1.01 [CI, 0.79 to 1.29]) and prothrombin gene mutation (OR, 1.37 [CI, 0.72 to 2.57]) were not (14).
- A 1999 systematic review of the relation between homocysteine, folic acid, and pregnancy complications, such as preeclampsia, included 5 case-control studies of preeclampsia. Hyperhomocysteinemia (pooled OR, 20.9 [CI, 3.6 to 121.6]) and homozygosity for the methylene tetrahydrofolate reductase thermolabile variant (OR, 2.6 [CI, 1.4 to 5.1]) were associated with a moderate risk for preeclampsia, and folate deficiency was not associated with preeclampsia (OR, 1.2 [CI, 0.5 to 2.7]) (15).
• A prospective multicenter cohort study evaluated risk factors for preeclampsia in 3572 "healthy" nulliparous women with a singleton pregnancy. Independent risk factors at 14 to 16 weeks' gestation included increased mean arterial BP (adjusted OR, 1.4 [CI, 1.2 to 1.5] for 5 mm Hg increase), increased BMI (adjusted OR, 1.3 [CI, 1.1 to 1.5] for 5-point increase), family history of preeclampsia (adjusted OR, 1.9 [CI, 1.3 to 2.9]), family history of coronary heart disease (adjusted OR, 1.8 [CI, 1.2 to 2.8]), and maternal birth weight. Protective factors included previous single miscarriage with the same partner (adjusted OR, 0.44 [CI, 0.21 to 0.92]), taking at least 12 months to conceive (adjusted OR, 0.41 [CI, 0.22 to 0.76]), and a high intake of fruit (adjusted OR, 0.65 [CI, 0.45 to 0.92]) (16).

• A population-based cohort study evaluated outcomes associated with polycystic ovarian syndrome. Polycystic ovarian syndrome was strongly associated with preeclampsia (adjusted OR, 1.45 [CI, 1.24 to 1.69]) (17).

Rationale
• The incidence of preeclampsia for all pregnancies is between 5% and 10%, and the incidence may increase to as high as 20% or more in women with a complicating condition listed for preeclampsia screening.

• Preeclampsia is associated with a significant maternal and fetal morbidity and mortality, some of which can be avoided by early identification and delivery.
3. Diagnosis

Diagnose hypertension in pregnancy when BP is >140/90 mm Hg, and classify it as chronic hypertension, preeclampsia, preeclampsia superimposed on chronic hypertension, or gestational hypertension.

3.1 Measure BP in all pregnant women at each visit in the sitting position, and define hypertension as BP ≥140/90 mm Hg.

Recommendations

- Diagnose hypertension in pregnancy if BP is ≥140/90 mm Hg when measured with the patient in a seated position with the antecubital fossa held at the level of the heart.
- Have the patient sit restfully for 5 minutes before the measurement.
- Base the diagnosis on two or more separate measurements of BP at least 4 hours apart.
- Record diastolic BP as Korotkoff sound 5 (K5).

Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended measuring BP when women are seated, with the arm at the level of the heart, and using Korotkoff phase V sounds to determine diastolic BP. The guideline defined hypertension in pregnancy as an average diastolic BP ≥90 mm Hg or systolic BP ≥140 mm Hg, based on at least two occasions, measured in the same arm at least 15 minutes apart.
- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined hypertension as a systolic BP ≥140 mm Hg, a diastolic BP ≥90 mm Hg, or both, on two measurements at least 4 hours apart. The report defined mild hypertension as a systolic BP ≥140 and <160 mm Hg and a diastolic BP ≥90 and <110 mm Hg.
- A 2010 NICE guideline on hypertension in pregnancy defined hypertension during pregnancy as a systolic BP of ≥190 mm Hg or a diastolic BP of ≥90 mm Hg. The guideline defined mild hypertension as a systolic BP of 140 to 149 mm Hg and a diastolic BP of 90 to 99 mm Hg, moderate hypertension as a systolic BP of 150 to 159 mm Hg and a diastolic BP of 100 to 109 mm Hg, and severe hypertension as a systolic BP ≥160 mm Hg and a diastolic BP ≥110 mm Hg. The guideline defined preeclampsia as new hypertension after 20 weeks’ gestation with significant proteinuria, defined as 24-hour urinary protein >300 mg or spot urine protein-to-creatinine ratio of 30 mg/mmol.
- A review of over 100 case reports of supine hypotensive syndrome in the literature emphasizes the fact that some patients without symptoms have significant drops in BP while supine.
- A cross-sectional study of 125 nulliparous pregnant women after 28 weeks’ gestation and in 42 nonpregnant control subjects showed that arterial BP in the left lateral position was lower than in the supine position and that this difference was due largely to differences in hydrostatic pressure.
- A study that examined the precision of measurements of K4 and K5 had two pairs of observers measure BP simultaneously by sphygmomanometry. K5 was identified in all measurements by both observers and never approached zero; K4, however, was heard by both clinicians in only 19% of readings.

Rationale

- BP should be monitored when the patient is sitting because...
Lying on the back in pregnancy may cause supine hypertensive syndrome
Measuring BP with the patient in the left lateral decubitus position causes an underestimation of BP if the patient's arm is held above the level of the heart
K₅ (the disappearance of sound) has been recommended by the International Society for the Study of Hypertension in Pregnancy because it reflects more accurately the diastolic pressure and because K₄ (the muffling of sound) is often recorded inaccurately.

Comments
• The roles of home and 24-hour ambulatory BP monitoring in the diagnosis of hypertension during pregnancy remain undefined.

3.2 Diagnose chronic hypertension when the BP is ≥140/90 mm Hg before 20 weeks' gestation.

Recommendations
• Diagnose chronic hypertension if BP is ≥140/90 mm Hg before conception or before 20 weeks' gestation, or both.
• Evaluate for underlying causes of hypertension.

Evidence
• A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada defined preexisting hypertension as hypertension that predates pregnancy or occurs before 20 weeks' gestation.
• A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined chronic hypertension as hypertension (BP ≥140/90 mm Hg) before pregnancy or during pregnancy before 20 weeks' gestation.
• A 2010 NICE guideline on hypertension in pregnancy defined chronic hypertension as hypertension present at the first prenatal visit or before 20 weeks' gestation.

Rationale
• Preeclampsia and gestational hypertension are rarely found before 20 weeks' gestation, so BP elevation before then is almost always due to chronic hypertension.
• Women in this group are at increased risk for preeclampsia and perinatal mortality.

Comments
• Chronic hypertension occurs in 1% to 5% of pregnancies.
• Hypertension that persists beyond 12 weeks postpartum is also classified as chronic hypertension, even if it was not diagnosed before pregnancy or before 20 weeks' gestation.
• Gestational trophoblastic disease is a rare condition that can lead to preeclampsia before 20 weeks' gestation.
• This classification system is based on the National High Blood Pressure Education Program's Working Group Classification and was developed by expert consensus (22).

3.3 Diagnose preeclampsia in women after 20 weeks' gestation who have new onset of high BP (≥140/90 mm Hg) and proteinuria.

Recommendations
• Diagnose preeclampsia if the patient is past 20 weeks' gestation and if both of the following criteria are met:
  • BP determinations made on two separate occasions and performed 4 hours apart are newly found to be ≥140/90 mm Hg
Proteinuria is present (defined as a protein excretion of ≥300 mg in 24 hours, >165 mg in 12 hours, or a urinary protein-to-creatinine ratio ≥0.3)

In patients with new hypertension who do not have proteinuria, diagnose preeclampsia if they have one of the following:
- Platelet count <100,000 /mCL
- Elevated creatinine level (>1.1 mg/dL or double the baseline value)
- Elevated transaminase levels (at least twice normal)
- Pulmonary edema
- Cerebral or visual symptoms

Diagnose severe preeclampsia if any of the following are present:
- BP >160 mm Hg systolic or >110 mm Hg diastolic
- Oliguria <500 mL per 24 hours
- Elevated serum creatinine level
- Epigastric pain
- Thrombocytopenia
- Microangiopathic hemolytic anemia
- Intrauterine growth restriction
- Oligohydramnios
- Elevated transaminase levels
- Pulmonary edema
- Eclampsia

Diagnose eclampsia if coma, stupor, confusion, or a seizure that cannot be attributed to another cause occurs in a patient with preeclampsia.

See module Preeclampsia.

Evidence
- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada defined preeclampsia as new or worsening with one or more adverse conditions (e.g., proteinuria) or one or more severe complications.

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined preeclampsia as hypertension (BP ≥140/90 mm Hg on two occasions 4 hours apart or ≥160/110 mm Hg in a patient with previously normal BP) plus proteinuria (≥300 mg in 24 hours or urinary protein-to-creatinine ratio ≥0.3). The task force recommended diagnosing preeclampsia in patients without proteinuria but with either a platelet count of <100,000/mCL, elevated creatinine level (>1.1 mg/dL or double the baseline value in the absence of another cause), liver enzyme levels twice normal, pulmonary edema, or cerebral or visual symptoms. The report noted that women with preeclampsia and pulmonary edema, renal insufficiency, and visual or CNS disturbance are considered to have severe disease.

- A 2010 NICE guideline defined preeclampsia as new hypertension after 20 weeks' gestation with significant proteinuria, defined as 24-hour urinary protein >300 mg or spot urine protein-to-creatinine ratio of 30 mg/mmol.

Rationale
- Identifying women whose BP elevation is attributable to preeclampsia is critical because of the increased maternal and fetal morbidity and mortality associated with this diagnosis.

- Proteinuria must be present to diagnose preeclampsia definitively because the use of BP criteria alone causes some women with chronic hypertension to be misdiagnosed with preeclampsia. This is because some women with elevation in BP as an isolated finding in the third trimester simply
manifest chronic hypertension that was masked earlier in the pregnancy by the normal 10 to 15 mm Hg drop in BP that occurs in the first 20 weeks of pregnancy. Other women with elevations in BP toward the end of their pregnancy simply have gestational hypertension, a diagnosis that carries with it less risk than preeclampsia.

Comments

- Note that hypertension is not always the presenting feature of preeclampsia. Other symptoms, signs, or laboratory manifestations of preeclampsia in the absence of hypertension still warrant careful evaluation of mother and fetus and, in some cases, consideration of hospitalization and delivery.
- This classification system is based on the National High Blood Pressure Education Program's Working Group Classification and was developed by expert consensus (22).

3.4 Diagnose preeclampsia superimposed on chronic hypertension when chronic hypertension (BP >140/90 mm Hg before 20 weeks' gestation) is accompanied by acute rise in BP, new-onset or sudden increase in proteinuria, thrombocytopenia, or elevated transaminase levels.

Recommendations

- Diagnose preeclampsia superimposed on chronic hypertension in women with chronic hypertension and no proteinuria early in pregnancy (before 20 weeks) if there is new-onset proteinuria (>300 mg in a 24-hour urine collection).
- Diagnose preeclampsia superimposed on chronic hypertension in women with chronic hypertension and proteinuria before 20 weeks' gestation if any of the following are seen:
  - Sudden increase in proteinuria
  - Sudden increase in BP
  - Thrombocytopenia (<100,000 mcL)
  - Elevated transaminase levels
- See module Preeclampsia.

Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada defined preexisting hypertension with evidence of preeclampsia (also called superimposed preeclampsia) as preexisting hypertension with the development of resistant hypertension, new or worsening proteinuria, or adverse conditions or severe complications after 20 weeks' gestation.
- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined chronic hypertension with superimposed preeclampsia in patients who develop proteinuria after 20 weeks' gestation and in pregnant women with acutely worsening hypertension or in those who develop a new platelet count of <100,000/mcL, an elevated creatinine level (>1.1 mg/dL or double the baseline value in the absence of another cause), liver enzyme levels twice normal, pulmonary edema, or cerebral or visual symptoms.
- In a prospective study of 763 women with chronic hypertension, 193 (25%) developed superimposed preeclampsia. The frequency of preeclampsia was greater in women who had hypertension for at least 4 years (31% vs. 22%; OR, 1.6 [CI, 1.1 to 2.2]) and in those with preeclampsia during a previous pregnancy (32% vs. 23%; OR, 1.6 [CI, 1.1 to 2.3]) (23).

Rationale

- The diagnosis of preeclampsia superimposed on chronic hypertension identifies a group of women with increased risk for perinatal and maternal morbidity and mortality compared with women who have chronic hypertension but do not develop preeclampsia.
Comments

- Recognize that although hypertension must be present for preeclampsia to be diagnosed definitively, hypertension is not always the presenting feature of preeclampsia. Other symptoms, signs, or laboratory manifestations of preeclampsia in the absence of hypertension still warrant careful evaluation of mother and fetus and, in some cases, consideration of hospitalization and delivery.
- This classification system is based on the National High Blood Pressure Education Program's Working Group Classification and was developed by expert consensus (22).

3.5 Diagnose gestational hypertension when there is de novo presentation of elevated BP after 20 weeks' gestation without other signs of preeclampsia (proteinuria).

Recommendations

- Diagnose gestational hypertension when BP elevation is detected for the first time after 20 weeks' gestation, without proteinuria.
- Understand that gestational hypertension is a temporary diagnosis that either resolves itself or progresses to meet criteria for preeclampsia or chronic hypertension:
  - Diagnose transient hypertension retrospectively if gestational hypertension resolves by 12 weeks' postpartum
  - Diagnose chronic hypertension retrospectively if elevated BP persists after 12 weeks postpartum
- Consider transient hypertension a diagnosis of exclusion, with preeclampsia and chronic hypertension first being ruled out carefully.

Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada defined gestational hypertension as hypertension that develops for the first time after 20 weeks' gestation.
- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined gestational hypertension as new-onset hypertension after 20 weeks' gestation without proteinuria.
- A 2010 NICE guideline defined gestational hypertension as new-onset hypertension after 20 weeks' gestation without proteinuria.

Rationale

- Women with transient hypertension are at low risk for adverse perinatal outcomes but are at risk for future primary hypertension.

Comments

- BP normally decreases by as much as 10 to 15 mm Hg in the first half of pregnancy and then returns to its prepregnancy baseline by term. Therefore, mild chronic hypertension in some women is masked in the first two trimesters and subsequently manifests in the latter half of pregnancy. If prepregnancy BP measurements are not available, it is difficult to be certain if patients who have high BP for the first time in the second half of pregnancy have preeclampsia or chronic hypertension.
- This classification system was developed by the National High Blood Pressure Education Program's Working Group as an expert consensus statement (22).

3.6 Use laboratory evaluation to confirm preeclampsia in pregnant women with newly diagnosed or worsening hypertension after 20 weeks' gestation.

Recommendations
• Look for proteinuria in patients with suspected preeclampsia by measuring
  • A timed (12- to 24-hour) urine collection
  • A spot urinary protein-to-creatinine ratio
  • A urine dipstick only if there are no other available tests
• Diagnose significant proteinuria in patients with
  • Urinary protein excretion of ≥300 mg/24 hours
  • Urinary protein excretion of >165 mg/12 hours
  • A urine protein-to-creatinine ratio ≥0.3 mg/dL or 30 mg/mmol
• In patients with proteinuria or in those without proteinuria in whom preeclampsia is still suspected, check
  • Creatinine level
  • Serum uric acid levels
  • Serum liver transaminase levels, LDH, albumin, and bilirubin levels
  • CBC with platelet count
  • Peripheral blood smear
• If the history, physical exam, and lab evaluation do not support the diagnosis of preeclampsia, evaluate the patient for underlying causes of hypertension in the same manner as for patients with hypertension before 20 weeks’ gestation.
• See table Differential Diagnosis of Hypertension in Pregnancy.
• See table Laboratory and Other Studies for the Presence of Preeclampsia in the Hypertensive Pregnant Woman.
• See module Preeclampsia.

Evidence
• A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended that pregnant women with preexisting hypertension have serum creatinine, fasting blood glucose, serum potassium, urinalysis, and electrocardiogram performed during early pregnancy if not previously documented. The guideline recommended that women with suspected preeclampsia be tested with urinalysis, pulse oximetry, CBC, coagulation testing (PT, PTT, and fibrinogen), serum creatinine, uric acid, glucose, AST or ALT, LDH, bilirubin, and albumin, and recommended a number of fetal tests as well.
• A 2013 report of the ACOG Task Force on Hypertension in Pregnancy defined preeclampsia as hypertension (BP ≥140/90 mm Hg on two occasions 4 hours apart or ≥160/110 mm Hg in a patient with previously normal BP) plus proteinuria (≥300 mg in 24 hours or urinary protein-to-creatinine ratio ≥0.3). The task force recommended diagnosing preeclampsia in patients without proteinuria but with either a platelet count of <100,000/mcL, an elevated creatinine level (>1.1 mg/dL or double the baseline value in the absence of another cause), liver enzyme levels twice normal, pulmonary edema, or cerebral or visual symptoms. The report recommended that women with preeclampsia have their CBC, liver enzyme levels, and serum creatinine level checked.
• A 2010 NICE guideline defined preeclampsia as new hypertension after 20 weeks’ gestation with significant proteinuria, defined as 24-hour urinary protein >300 mg or spot urine protein-to-creatinine ratio 30 mg/mmol.
• A 2012 systematic review of the diagnostic accuracy and prognostic value of spot urinary protein-to-creatinine ratio in pregnant women with suspected preeclampsia included 20 studies with 2978 participants. Pooled sensitivity was highest at a threshold of 0.13 to 0.14 (sensitivity, 89%; specificity, 63% to 64%); pooled specificity was highest at a threshold of 0.50 (specificity, 87%;
sensitivity, 65%). At a threshold of 0.30, sensitivity and specificity were 81% and 76%, respectively (24).

- A 2004 systematic review of the diagnostic accuracy of urine dipsticks for the diagnosis of hypertensive disorders in pregnancy included 7 studies. At a threshold of 1+ proteinuria, urinary dipsticks had a pooled sensitivity of 55%, a specificity of 84%, a positive LR of 3.48 (CI, 1.66 to 7.27), and a negative LR of 0.6 (CI, 0.45 to 0.80) (25).

- A study evaluated the diagnostic accuracy of 12-hour urinary protein and protein-to-creatinine ratio in pregnant women with suspected preeclampsia compared with the reference standard of 24-hour urine protein. A 12-hour urine protein of >165 mg had a sensitivity of 96% and a specificity of 100%; urine protein-to-creatinine ratio had a sensitivity of 89% and a specificity of 49% (26).

**Rationale**

- Proteinuria defines preeclampsia in pregnant women with hypertension.

- CBC, AST, creatinine, uric acid, and a 24-hour urine test for protein screen for additional evidence of preeclampsia.

**Comments**

- Some clinicians would also check serum TSH and calcium levels to exclude thyroid and parathyroid disease as a cause of hypertension in this population.

### 3.7 Evaluate pregnant women with newly diagnosed chronic hypertension before 20 weeks' gestation for end-organ damage.

**Recommendations**

- Obtain electrolytes, creatinine level, and urine protein.

- Consider secondary causes of hypertension, especially if the patient is younger than age 25, has a negative family history, or has hypertension that is severe, sudden in onset, or difficult to control with medications.

- See [Laboratory and Other Studies for the Presence of Preeclampsia in the Hypertensive Pregnant Woman](#).

- See module [Essential Hypertension](#).

**Evidence**

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended that pregnant women with preexisting hypertension have serum creatinine, fasting blood glucose, serum potassium, urinalysis, and electrocardiogram performed during early pregnancy if not previously documented. The guideline recommended that women with suspected preeclampsia be tested with urinalysis, pulse oximetry, CBC, coagulation testing (PT, PTT, and fibrinogen), serum creatinine, uric acid, glucose, AST or ALT, LDH, bilirubin, and albumin, and recommended a number of fetal tests as well.

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended that the lab tests, including CBC, electrolytes, liver function tests, uric acid, and urine protein, be performed for patients with chronic hypertension diagnosed during pregnancy, and that patients with suspected secondary hypertension be referred to a hypertension specialist.

- A 2010 NICE guideline on hypertension in pregnancy discussed the importance of close BP monitoring during pregnancy for patients with chronic hypertension.

**Rationale**

- Chronic hypertension without preeclampsia is evaluated in the same manner as for nonpregnant patients.
Comments

- Patients with proteinuria or abnormal creatinine levels may have CKD as an underlying cause of hypertension.
- Some clinicians would also check serum TSH and calcium levels to rule out thyroid and parathyroid disease as a cause of hypertension in this population.

3.8 Consider secondary causes in pregnant patients with chronic hypertension.

Recommendations

- Rule out underlying causes by history, physical exam, and lab evaluation in all women with hypertension.
- Consider secondary hypertension, particularly if the patient is younger than 25 years of age, has no family history of hypertension, has severe hypertension, or has hypertension that began suddenly or is difficult to control with medication.

Evidence

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended that patients with suspected secondary hypertension undergo a work-up and be referred to a hypertension specialist.

Rationale

- Because 5% of patients with chronic hypertension have an underlying medical disorder, possible underlying causes should be considered for all newly hypertensive patients.
- Secondary causes of hypertension (especially pheochromocytoma and renal disease) likely increase the risk for preeclampsia and may have a direct effect on maternal outcome.
4. Consultation

Consult appropriate specialists for the diagnosis of secondary causes of hypertension; closely involve an obstetrician if preeclampsia is suspected. Closely involve obstetricians in management; consult medical subspecialists when secondary causes of hypertension are suspected.  

4.1 Refer pregnant patients with suspected endocrine causes of hypertension to the appropriate specialists.

**Recommendations**

- Refer pregnant patients with suspected hypercortisolism, pheochromocytoma, hyperaldosteronism, or parathyroid disease to an endocrinologist.

**Evidence**

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended that patients with suspected secondary hypertension undergo a work-up and be referred to a hypertension specialist.
- A 1998 narrative review discussed the diagnosis and management of endocrine causes of hypertension and made clear the endocrinologist's important role. (27)

**Rationale**

- Diagnosis of suspected hypercortisolism, pheochromocytoma, and hyperaldosteronism may require an endocrinologist.

**Comments**

- Less than 5% of hypertension has an underlying medical cause.

4.2 Refer pregnant patients with suspected renal causes of hypertension to a nephrologist.

**Recommendations**

- Refer pregnant patients with elevated creatinine level, abnormal urinalysis result, or significant proteinuria in association with hypertension before 20 weeks' gestation to a nephrologist.

**Evidence**

- Consensus.

**Rationale**

- Identification of renal disease in a pregnant woman may require consultation with a nephrologist regarding renal biopsy and medical management.

4.3 Contact an obstetrician promptly if preeclampsia is suspected.

**Recommendations**

- Consult an obstetrician emergently for any symptoms, signs, or laboratory findings that suggest preeclampsia to ensure that the patient receives appropriate fetal evaluation and consideration for hospitalization.
- See module Preeclampsia.

**Evidence**

- Consensus.
Rationale
- Preeclampsia is a serious disease that obstetricians have particular experience in diagnosing and treating. Suspicion of preeclampsia may warrant close obstetric follow-up, fetal monitoring, and possible hospitalization.

4.4 **Recommend ongoing obstetrical care as essential to the care of hypertension in pregnancy.**

**Recommendations**
- Note that all pregnant women with hypertension should be followed throughout the pregnancy by an obstetrician.

Evidence
- Consensus.

Rationale
- Obstetricians are uniquely trained in the identification and management of preeclampsia.
- Chronic hypertension can have significant fetal effects, including intrauterine growth restriction, miscarriage, and placental abruption, that require obstetrical expertise and monitoring.

4.5 **Contact the managing obstetrician promptly if there are any features that suggest preeclampsia.**

**Recommendations**
- Consult an obstetrician emergently for any symptoms, signs, and laboratory findings that suggest preeclampsia to ensure that the patient receives appropriate fetal evaluation and consideration of need for hospitalization.
  - Symptoms of preeclampsia are headache, visual phenomena, epigastric pain, and facial edema
  - Signs of preeclampsia include elevated BP, retinal vasospasm, epigastric tenderness, clonus, and marked edema
  - Lab abnormalities that suggest preeclampsia include hemoconcentration, thrombocytopenia, creatinine level >0.8 mg/dL (70 mmol/L), uric acid level >5 mg/dL (0.3 mmol/L), proteinuria on urinalysis or 24-hour urine collection, and elevated AST level
- See module [Preeclampsia](#).

Evidence
- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended immediate delivery of women with severe preeclampsia and consideration of delivery of any woman with preeclampsia at >37 weeks' gestation. For women with gestational hypertension at >37 weeks' gestation, the guideline recommended delivery within days and for those with preexisting hypertension, the guideline recommended delivery at 38 or 39 weeks.
- A 2013 report of the ACOG Task Force on Hypertension in pregnancy recommended delivery in patients with mild gestational hypertension or preeclampsia at 37 weeks' gestation or severe preeclampsia after 34 weeks' gestation, and in unstable patients as soon as they are stabilized. The guideline stated that women with preeclampsia do not need to have cesarean delivery and recommended that mode of delivery be determined based on maternal and fetal factors.
- A 2010 NICE guideline on hypertension in pregnancy recommended that delivery before 37 weeks be offered only to patients with BP >160/110 mm Hg and only after a course of corticosteroids.
- A randomized, controlled trial of 756 women with gestational hypertension or mild preeclampsia at 36 to 41 weeks' gestation who were randomly assigned to induction of labor versus expectant monitoring showed that induction of labor reduced incidence of severe hypertension, although the
study was inadequately powered to detect differences in maternal or neonatal death or morbidity \( (28) \).

### Rationale

- Obstetricians are uniquely trained in the identification and management of preeclampsia.
- Preeclampsia can have significant fetal effects (e.g., intrauterine growth restriction, miscarriage, placental abruption) that require obstetrical expertise and monitoring.
- Preeclampsia often requires hospitalization and delivery.

#### 4.6 Consider consultation with medical subspecialists for the management of secondary causes of hypertension.

### Recommendations

- Consult the appropriate medical specialists, including maternal–fetal medicine (i.e., a “high-risk” obstetrician) if the history, physical exam, and lab evaluation suggest a secondary cause of hypertension.

### Evidence

- Consensus.

### Rationale

- The management of secondary causes of hypertension in pregnancy is challenging, and experience is often limited. Use of experts in the field helps ensure the best possible outcome for mother and fetus.

#### 4.7 Consider consultation with medical subspecialists when preeclampsia causes significant organ failure.

### Recommendations

- Consult a neurologist or neurosurgeon when preeclampsia is complicated by a CNS bleed or status epilepticus.
- Consult a critical care specialist or pulmonologist when preeclampsia is complicated by pulmonary edema that requires intubation.
- Consult a hematologist for preeclampsia complicated by severe hemolysis or thrombocytopenia (for the consideration of steroids or plasmapheresis use).
- Consult a nephrologist for preeclampsia complicated by worsening renal failure (for aid in the differential diagnosis).
- See module Preeclampsia.

### Evidence

- Consensus.

### Rationale

- Severe manifestations of preeclampsia are life threatening, and the use of experts in the field helps ensure the best possible outcome for mother and fetus.
5. Hospitalization

Hospitalize patients with clear manifestations of preeclampsia under the care of an obstetrician.

5.1 Hospitalize patients with clear manifestations of preeclampsia or consider enrollment in a comprehensive home-monitoring program under the care of an obstetrician.

Recommendations

- Hospitalize women with preeclampsia and
  - BP >160/110 mm Hg
  - Signs of liver, kidney, hematologic, or CNS dysfunction
  - Signs of fetal distress, oligohydramnios, placental abruption, or rupture of membranes
- For patients with mild new-onset preeclampsia,
  - Consider hospitalization
  - Consider outpatient management with a home-monitoring program and frequent clinical and fetal evaluation and restricted activity
- Consult with an appropriate obstetric specialist or subspecialist on using these data to decide on continued antepartum management or delivery.
- See module Preeclampsia.

Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended inpatient care for patients with preeclampsia or severe hypertension.
- A 2010 NICE guideline on the management of hypertensive disorders of pregnancy recommended that patients with gestational hypertension and BP >160/110 mm Hg be admitted to the hospital.
- A group of 321 patients with mild preeclampsia were enrolled in a program of bed rest at home with daily biochemical and fetal assessments and weekly clinic visits. Women enrolled in the program had an average reduction of 2 days' (from 5.7 to 3.7 days) hospital stay when compared with other women with preeclampsia. No patient had eclampsia, disseminated intravascular coagulopathy, placental abruption, or fetal loss related to preeclampsia while in the program. The estimated cost savings in the management of preeclampsia was more than $700,000 over the study period (29).
- Antenatal day care (vs. standard care on an antenatal ward) may have similar perinatal outcomes based on a randomized, controlled trial of 395 women with nonproteinuric hypertension, proteinuric hypertension (mild preeclampsia), and premature rupture of membranes, although results are limited by the small number of participants (30).

Rationale

- Patients with clear manifestations of preeclampsia are at risk for accelerated hypertension, pulmonary edema, severe thrombocytopenia, seizures, and intrauterine fetal death. Expectant management with close monitoring of fetal and maternal status is the most prudent course.

Comments

- The present standard of care for patients with clear manifestations of preeclampsia in the U.S. and Canada is hospitalization or enrollment in a comprehensive home-monitoring program; however,
investigation into the role of outpatient management of hypertensive disorders in pregnancy is ongoing.

- Although inpatient management is ideal for safety, an ongoing effort to explore home monitoring for mild preeclampsia has had some promising clinical trial results.
6. Therapy

Use drug therapy to treat BP ≥150/100 mm Hg in pregnancy.

6.1 Do not recommend salt restriction or other lifestyle modifications as the sole therapy for hypertension in pregnancy.

Recommendations
- Do not recommend salt restriction in pregnancy.
- Do not recommend magnesium or fish oil to prevent preeclampsia.
- Recommend that pregnant women maintain adequate calcium intake, and consider supplementation in women with low intake of dietary calcium and those at high risk for preeclampsia.
- Note that bedrest is widely recommended in women with elevations of BP in the third trimester, but its benefits have never been proven.

Evidence
- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended calcium intake of at least 1 g/day, using supplements if necessary, and recommended against dietary salt restriction in pregnant women with hypertension. The guideline stated that the evidence is insufficient to support other lifestyle interventions.
- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended against weight loss and low-sodium diet for pregnant patients with chronic hypertension and stated that women with well-controlled BP who usually exercise can safely continue moderate exercise during pregnancy.
- A 2010 NICE guideline on hypertension in pregnancy recommended that pregnant women with chronic hypertension maintain a low-salt diet but did not recommend frank salt restriction.
- A 2010 Cochrane review of calcium supplementation to prevent pregnancy-related hypertension included 13 studies with 15,730 women. Calcium was associated with a lower risk for hypertension (RR, 0.65 [CI, 0.53 to 0.81]) and preeclampsia (RR, 0.45 [CI, 0.31 to 0.65]) compared with placebo, with the greatest effect among high-risk women and those with low baseline calcium intake (2).
- A 2005 Cochrane review of bedrest on pregnancy-related hypertension included 4 trials with 449 participants. There was insufficient evidence of an impact on clinical outcomes (31).

Rationale
- Bedrest, salt restriction, magnesium, and fish oil all have been evaluated as possible methods of preventing the progression of preeclampsia but have not been shown to be effective.

Comments
- Although bedrest has not been proven to alter the outcome in hypertensive disorders of pregnancy, it is still traditionally recommended for women with preeclampsia who are remote from term and are being managed expectantly (i.e., not being delivered).

6.2 Manage mild hypertension (BP <150/100 mm Hg) expectantly with observation and no medication during pregnancy.

Recommendations
- Offer to women with mild hypertension the option of being managed without medication during pregnancy so long as their BP stays <150/100 mm Hg.
Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended a goal BP of <160/110 mm Hg in pregnant women with severe hypertension, goal systolic BP of 130 to 165 mm Hg and goal diastolic BP 80 to 105 mm Hg in women with nonsevere uncomplicated hypertension, and goal BP <140/90 mm Hg for women with nonsevere hypertension with comorbid conditions.

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended antihypertensive therapy for pregnant women with systolic BP ≥160 mm Hg or diastolic BP ≥105 mm Hg.

- A 2010 NICE guideline on the management of hypertensive disorders in pregnancy recommended antihypertensive therapy for patients with preeclampsia and either moderate (systolic BP, 150 to 159 mm Hg; diastolic BP, 100 to 109 mm Hg) or severe (systolic BP, ≥160 mm Hg; diastolic BP, 110 mm Hg) hypertension, with oral labetolol as the first-line agent. The guideline recommended a goal systolic BP <150 mm Hg and a diastolic BP of 80 to 100 mm Hg for all types of hypertension in pregnancy.

- A 2014 Cochrane review of antihypertensive therapy for mild to moderate hypertension during pregnancy included 49 trials with 4723 participants. Antihypertensive therapy reduced the risk for developing severe hypertension (RR, 0.49 [CI, 0.40 to 0.60]) but did not reduce the risk for preeclampsia (RR, 0.93 [CI, 0.80 to 1.08]), preterm birth (RR, 0.96 [CI, 0.85 to 1.10]), or fetal death (RR 0.71 [CI, 0.49 to 1.02]) (32).

- A 2011 Cochrane review of tight (BP <140/90 mm Hg or diastolic BP <100 mm Hg) vs. very tight (BP 130/80 mm Hg or diastolic BP <85 mm Hg) BP control included two randomized trials with 256 participants. There were no differences between the groups in severe preeclampsia (RR, 1.28 [CI, 0.97 to 1.700]) (33).

- A 2000 systematic review of the relationship between fall in BP and fetal growth included 14 studies. Overall, lower mean arterial pressure with antihypertensive treatment was associated with higher rates of small-for-gestational-age infants and lower mean birth weights (34).

Rationale

- Nine months of uncontrolled mild hypertension is unlikely to have deleterious effects on the mother and has not been shown to have significant effect on the fetus. Most of the morbidity associated with hypertension in pregnancy is from superimposed preeclampsia, and this is not prevented by “tight” BP control.

- Overtreatment of hypertension in pregnancy may adversely affect the fetus.

6.3 Recommend antihypertensive medication in patients with BP ≥150/100 mm Hg in pregnancy, generally starting with labetolol or nifedipine in most patients.

Recommendations

- Treat persistent BP ≥150/100 mm Hg in pregnancy.

- Start most patients on one of the following:
  - Labetolol
  - Nifedipine
  - Hydralazine or methyldopa if other drugs are not tolerated or not available

- Treat acute BP >160 to 180/100 to 105 mm Hg emergently.
  - Use labetolol, nifedipine, or hydralazine for urgent therapy.

- See Drug Treatment for Chronic Hypertension In Pregnancy.
Evidence

- A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended a goal BP of <160/110 mm Hg in pregnant women with severe hypertension, goal systolic BP of 130 to 165 mm Hg and goal diastolic BP 80 to 105 mm Hg in women with nonsevere uncomplicated hypertension, and goal BP <140/90 mm Hg for women with nonsevere hypertension with comorbid conditions. The guideline recommended labetolol, other β-blockers, and calcium-channel blockers (nifedipine), and either hydralazine (severe hypertension) or methyldopa (nonsevere hypertension). The guideline recommended against ACE inhibitors and atenolol during pregnancy.

- A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended antihypertensive medication for patients with chronic hypertension and systolic BP ≥160 mm Hg or diastolic BP ≥105 mm Hg, with a goal systolic BP of 120 to 160 mm Hg and diastolic BP of 80 to 105 mm Hg. The guideline recommended labetolol, nifedipine, and methyldopa as first-line agents.

- A 2010 NICE guideline on the management of hypertensive disorders in pregnancy recommended antihypertensive therapy for patients with preeclampsia and either moderate (systolic BP, 150 to 159 mm Hg; diastolic BP, 100 to 109 mm Hg) or severe (systolic BP, ≥160 mm Hg; diastolic BP, 110 mm Hg) hypertension, with oral labetolol as the first-line agent. The guideline recommended a goal systolic BP <150 mm Hg and a diastolic BP of 80 to 100 mm Hg for all types of hypertension in pregnancy.

- A 2013 Cochrane review of drugs for the treatment of very high BP during pregnancy included 35 trials with 3573 participants. Compared with hydralazine, calcium-channel blockers led to lower rates of persistent hypertension (RR, 0.37 [CI, 0.21 to 0.66]), and ketanserin led to higher rates (RR, 4.79 [CI, 1.95 to 11.73]). Compared with diazoxide, labetolol led to a lower risk for hypotension (RR, 0.06 [CI, 0.00 to 0.99]) and a trend toward a lower rate of cesarean section (RR, 0.43 [CI, 0.18 to 1.02]). Magnesium sulfate and nimodipine led to high rates of persistent hypertension (35).

- A retrospective cohort study of pregnancy outcomes in hypertensive women showed that severe hypertension (diastolic BP ≥110 mm Hg) before 20 weeks' gestation was associated with a trend of increased risk for babies who are small for their gestational age (OR, 3.8 [CI, 1.0 to 13.7]), increased rate of delivery at less than 32 weeks (OR, 7.4 [CI, 1.9 to 29.5]), and increased rate of superimposed preeclampsia (OR, 5.2 [CI, 1.5 to 17.2]). Whether control of BP reduces these risks is not known (36).

- A retrospective cohort study of 100,029 deliveries from 1998 to 2008 showed untreated chronic hypertension, compared with no hypertension, was associated with an increased risk for preeclampsia, preterm delivery, intrauterine growth restriction, and small-for-gestational-age infants (37).

Rationale

- Uncontrolled severe hypertension is associated with an increased risk for poor pregnancy outcome, even in the absence of superimposed preeclampsia.
7. Patient Counseling

Educate patients on the current treatment of hypertension during pregnancy and on how to watch for symptoms that require medical attention.

7.1 Teach patients the symptoms and signs of preeclampsia and the importance of prenatal care.

Recommendations
- Teach patients to report changes in headache pattern, visual phenomena, epigastric pain, facial and hand edema, and sudden unexpected weight gain occurring after 20 weeks' gestation.

Evidence
- Consensus.

Rationale
- Early communication with the physician can lead to earlier diagnosis of preeclampsia and thus a prevention of negative outcomes.

7.2 Inform all women diagnosed with chronic hypertension about the long-term risks of hypertension.

Recommendations
- Teach women in whom chronic hypertension is diagnosed that hypertension is an important risk factor for CAD, CVD, and renal disease.
- Recommend modification of all concomitant risk factors for CAD (e.g., smoking cessation, lipoprotein levels). Cholesterol screening should be delayed until at least 6 weeks postpartum because pregnancy is associated with a physiologic hyperlipidemia.

Evidence
- Consensus.

Rationale
- CAD, CVD, and renal disease are all significant causes of mortality and morbidity among women and warrant aggressive preventive health intervention.
8. Follow-up

Monitor all women with chronic hypertension during pregnancy for BP control and the development of preeclampsia.

8.1 Maintain close monitoring of BP during pregnancy in women with chronic or gestational hypertension, and careful observation for the development of preeclampsia.

Recommendations

- Evaluate women with chronic hypertension in pregnancy a minimum of once per month for the first 24 weeks, and then every 1 to 3 weeks for the duration of the pregnancy.
- Test for proteinuria at all visits.
- For pregnant patients with severe hypertension (≥160/110 mm Hg), monitor BP at least daily, test for proteinuria daily, and use the following lab tests to evaluate for complications:
  - CBC
  - Electrolyte, BUN, and creatinine levels
  - Transaminase and bilirubin levels

Evidence

- A 2010 NICE guideline on the management of hypertensive disorders in pregnancy recommended that patients with gestational hypertension have their BP checked up to weekly for mild hypertension, at least twice per week for moderate hypertension, and four times per day for severe hypertension. The guideline recommended testing for proteinuria at each visit in women with mild or moderate hypertension and daily in women with severe hypertension, and recommended weekly lab tests (renal function, electrolytes, liver function tests, and CBC) in those with severe hypertension to monitor for complications.

Rationale

- Physiologic changes in pregnancy may cause BP to drop in the first and second trimesters and to rise in the third. Physiologic changes of pregnancy (e.g., increases in the volume of distribution and in the rate of hepatic metabolism) also affect antihypertensive pharmacokinetics. Such changes may require alteration of drug therapy.
- Preeclampsia is a common and serious complication of pregnancy for which careful and regular screening is warranted.

Comments

- No outcomes-based data are available with respect to the ideal frequency of prenatal visits in women with chronic hypertension.

8.2 Follow patients with preeclampsia closely until delivery and monitor for complications.

Recommendations

- Monitor patients with chronic hypertension for
  - Rising BP
  - Proteinuria
  - New-onset headaches
  - Visual phenomena
  - Epigastric pain or tenderness
• Sudden excessive weight gain
• Profound edema
• Thrombocytopenia
• Elevated creatinine level
• Rising uric acid level
• Elevated AST level

• Follow patients with nonsevere preeclampsia closely:
  • Monitor BP at least twice weekly
  • Follow lab tests, including kidney function, blood counts, and liver testing 1 to 3 times per week
  • Follow up on any previously abnormal laboratory tests
  • Advise patients to follow fetal movement closely and report any decrease in activity
  • Consider hospitalization or enrollment in an intensive home-monitoring program for patients with mild preeclampsia.
  • See module [Preeclampsia](#).

Evidence

• A 2013 report of the ACOG Task Force on Hypertension in Pregnancy recommended that patients with preeclampsia closely monitor fetal activity and that BP be checked at least twice weekly.

• A 2010 NICE guideline on the management of hypertensive disorders of pregnancy recommended measuring BP at least 4 times per day, monitoring blood tests at least 3 times per week (kidney function, electrolytes, liver function tests, CBC), and maintaining close clinical follow-up for women with preeclampsia.

• A group of 321 patients with mild preeclampsia were enrolled in a program of bedrest at home, with daily biochemical and fetal assessments and weekly clinic visits. The program's availability resulted in an average reduction of 2 days (from 5.7 days to 3.7 days) in hospital stay when compared with other women who were not enrolled in the program. No patient had eclampsia, disseminated intravascular coagulopathy, abruption, or fetal loss related to preeclampsia while in the program. The estimated cost saving in the management of preeclampsia was >$700,000 over the study period. The authors concluded that a community-based home-care program is a safe, feasible, and less costly alternative to hospital admission for the management of mild preeclampsia (29).

• Antenatal day care (vs. standard care on an antenatal ward) may have similar perinatal outcomes based on a randomized, controlled trial of 395 women with nonproteinuric hypertension, proteinuric hypertension (mild preeclampsia), and premature rupture of membranes, although results are limited by the small number of participants (30).

Rationale

• Once preeclampsia is detected, patients can progress rapidly or suddenly, or both, to severe manifestations, such as severe hypertension, seizures, pulmonary edema, severe thrombocytopenia, and placental abruption.

8.3 Follow postpartum patients with hypertension closely for BP changes and medication adjustment to the nonpregnant physiologic state.

Recommendations

• Discharge women with chronic hypertension on a medication that controls BP.

• Note that if antihypertensive dosing has been increased during the pregnancy, the woman may be able to have her dose lowered in the weeks after delivery.
• Measure BP at 2, 4, and 6 weeks postpartum, and ask the patient to report any lightheadedness that suggests hypotension.

Evidence
• A 2014 guideline on hypertensive disorders of pregnancy from the Society of Obstetricians and Gynaecologists of Canada recommended measuring blood pressure in women with hypertensive disorders of pregnancy 3 to 6 days after delivery, and noted that nifedipine, methyldopa, captopril, and enalapril are considered safe during breastfeeding.

• A 2010 NICE guideline on the management of hypertensive disorders in pregnancy recommended that patients with gestational hypertension be followed closely after delivery, with BP checks daily for 2 days postpartum, once during days 3 to 5, and 2 and 6 weeks postpartum, with more frequent monitoring depending on individual patient factors.

Rationale
• The physiologic changes of pregnancy that may have required the increase in dose reverse themselves, and dose adjustments of antihypertensive agents may be required.

• Most antihypertensive agents are compatible with breast feeding.

Comments
• Preeclampsia, whether de novo or superimposed on chronic hypertension, can continue to exert an effect on BP for up to 6 to 12 weeks postpartum. In general, however, BP that remains elevated beyond 6 to 12 weeks postpartum suggests a diagnosis of chronic hypertension.

• Preeclampsia can present for the first time postpartum and is an important part of the differential diagnosis of hypertension that presents for the first time in the postpartum period. Other differential diagnoses include postpartum thyroiditis, Grave’s thyrotoxicosis (which can flare postpartum), and hyperaldosteronism (which can be masked during pregnancy by the aldosterone-antagonist effects of progesterone).

8.4 Evaluate all postpartum patients with chronic hypertension (hypertension present before the pregnancy and/or after 12 weeks postpartum) for other risk factors for CAD and CVD. Catherine L. Smith, MD

Recommendations
• In patients with chronic hypertension during pregnancy, at 12 weeks postpartum,
  • Check BP
  • Provide counseling on the benefits of exercise, maintaining ideal weight, and minimizing alcohol consumption in the control of BP

Evidence
• A 2010 systematic review of kidney disease after preeclampsia included 7 cohort studies. After a mean of 7 years of follow-up time, rates of microalbuminuria were higher in patients with preeclampsia (31% vs. 7%) (38).

• A 2008 systematic review of CVD in patients with preeclampsia included 5 case-control and 10 cohort studies. Compared with women with uncomplicated pregnancies, those with preeclampsia or eclampsia were at increased risk for cardiac disease in both cohort (RR, 2.33 [CI, 1.95 to 2.78]) and case-control (OR, 2.47 [CI, 1.22 to 5.01]) studies. Patients with preeclampsia were also at increased risk for cerebrovascular disease (RR, 2.03 [CI, 1.54 to 2.67]) and cardiovascular mortality (RR, 2.29 [CI, 1.73 to 3.04]) (39).

• A 2007 systematic review of the risk for later CVD in patients with preeclampsia included 25 observational studies. Compared with those with no history of preeclampsia, women with history of preeclampsia were at an increased risk for hypertension (RR, 3.70 [CI, 2.70 to 5.05]) after 14.1 years weighted mean follow-up; for ischemic heart disease (RR, 2.16 [CI, 1.86 to 2.52]) after 11.7...
years; for stroke (RR, 1.81 [CI, 1.45 to 2.27]) after 10.4 years; and for venous thromboembolism (RR, 1.79 [CI, 1.37 to 2.33]) after 4.7 years. No increase in risk for any cancer was found (RR, 0.96 [CI, 0.73 to 1.27]), including breast cancer (RR, 1.04 [CI, 0.78 to 1.39]), 17 years after preeclampsia. Overall mortality after preeclampsia was increased (RR, 1.49 [CI, 1.05 to 2.14) after 14.5 years (40).

Rationale
- Hypertension is a major risk factor for vascular disease, and its treatment should address other concomitant risk factors for vascular disease.

8.5 Evaluate pregnant patients with onset of hypertension after 20 weeks' gestation for preeclampsia regularly even if the initial evaluation is negative.

Recommendations
- Evaluate women with gestational hypertension a minimum of once per month for the first 24 weeks, and then every 1 to 3 weeks for the duration of the pregnancy.
- Test for proteinuria at all visits.
- For pregnant women with severe hypertension (≥160/110 mm Hg), monitor BP at least daily, test for proteinuria daily, and perform the following lab tests weekly to evaluate for complications:
  - CBC
  - Electrolyte, BUN, and creatinine levels
  - Transaminase and bilirubin levels
- Obtain fetal assessments regularly from the managing obstetrician.

Evidence
- A 2010 NICE guideline on the management of hypertensive disorders in pregnancy recommended that patients with gestational hypertension be followed closely after delivery, with BP checks daily for 2 days postpartum, once during days 3 to 5, and 2 and 6 weeks postpartum, with more frequent monitoring depending on individual patient factors.

Rationale
- Preeclampsia can be insidious and gradual in its onset but may accelerate rapidly.

Comments
- Hypertension is not always a presenting feature of preeclampsia. Presence of other symptoms, signs, or laboratory manifestations of preeclampsia in the absence of hypertension still warrants careful evaluation of mother and fetus and, in some cases, consideration of hospitalization and delivery.
- Preeclampsia may manifest gradually over time, so patients with hypertension in the second half of pregnancy need to be evaluated regularly for evidence of preeclampsia, even if the initial evaluation is negative.

8.6 Verify that preeclampsia-related abnormalities resolve postpartum.

Recommendations
- Repeat preeclampsia laboratory evaluations periodically postpartum until normal.
- Consider other diagnoses if laboratory evaluation and BP have not normalized by 6 to 12 weeks postpartum.

Evidence
- Consensus.

Rationale
• Primary renal disease, hepatic disease, and collagen vascular disease can all present during pregnancy with features that lead to the diagnosis of preeclampsia. Documenting normalization of all symptoms, signs, and laboratory manifestations of preeclampsia by 6 weeks postpartum helps prevent misdiagnosing other medical illnesses as preeclampsia.
References


Glossary

**ACOG**
American College of Obstetricians and Gynecologists

**ALT**
alanine aminotransferase

**AST**
aspartate aminotransferase

**BMI**
body mass index

**BP**
blood pressure

**BUN**
blood urea nitrogen

**CAD**
coronary artery disease

**CBC**
complete blood count

**CI**
confidence interval

**CNS**
central nervous system

**CKD**
chronic kidney disease

**CVD**
cardiovascular disease

**LDH**
lactic dehydrogenase

**NICE**
National Institute for Health and Clinical Excellence

**NNT**
count needed to treat

**OR**
odds ratio

**PT**
prothrombin time

**PTT**
partial thromboplastin time

**RR**
relative risk

**TSH**
thyrotopin
Hypertension in Pregnancy

Tables

Laboratory and Other Studies for the Presence of Preeclampsia in the Hypertensive Pregnant Woman

<table>
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<tr>
<th>Test</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Timed (24-hour) urine collection for protein</td>
<td>Reference standard for determining proteinuria. Proteinuria defined as protein excretion $\geq$300 mg in 24 hours</td>
</tr>
<tr>
<td>Urinary dipstick for protein</td>
<td>Accuracy is poor. Only recommended if there are no other available tests</td>
</tr>
<tr>
<td>Timed (12-hour) urine collection for protein</td>
<td>Twelve-hour protein $&gt;165$ mg has a sensitivity of 96% and a specificity of 100%</td>
</tr>
<tr>
<td>Urine protein-to-creatinine ratio</td>
<td>Cutoff of $\geq$30 mg/mmol or 0.30 mg/dL is generally used, although the sensitivity (81%) and specificity (76%) are moderate</td>
</tr>
<tr>
<td>CBC</td>
<td>Anemia is common in late pregnancy; normal or elevated hemoglobin in late pregnancy suggests preeclampsia-associated hemoconcentration. Thrombocytopenia with a platelet count $&lt;100,000$ can be a sign of severe preeclampsia</td>
</tr>
<tr>
<td>Peripheral blood smear</td>
<td>Schistocytes and burr cells can be seen in severe preeclampsia, representing microangiopathic hemolytic anemia</td>
</tr>
<tr>
<td>Uric acid levels</td>
<td>Hyperuricemia (levels $&gt;5$ mg/dL [300 $\mu$mol/L or 0.3 mmol/L]) can represent renal tubular dysfunction, which can precede the development of proteinuria in preeclampsia</td>
</tr>
<tr>
<td>Transaminases (ALT and AST)</td>
<td>Elevated transaminase levels more than twice the upper limit of normal are a sign of severe preeclampsia. If AST is elevated beyond 3 times the upper limit of normal, consider acute fatty liver of pregnancy or preeclampsia-related hepatic infarction</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>Normal creatinine level in pregnancy is $&lt;0.8$ mg/dL and creatinine clearance is as high as 150 mg/d.Elevated by intravascular volume depletion, renal artery vasospasm, and glomerular endotheliosis</td>
</tr>
<tr>
<td>Proteinuria $&gt;300$ mg per 24 hours on 24-hour urine collection for protein and CrCl</td>
<td>Normal CrCl in pregnancy is $&gt;150$. Normal 24-hour urine protein result in pregnancy is $&lt;300$ mg</td>
</tr>
<tr>
<td>INR and PTT</td>
<td>Elevations may be due to a consumptive coagulopathy. Check if hepatic transaminases are elevated, if platelets are low, and before cesarean delivery or other operative procedure</td>
</tr>
<tr>
<td>FDP</td>
<td>Order only if there are elevations in AST, INR, or PTT. Decreased fibrinogen with increased d-dimer and FDP levels suggest preeclampsia-related disseminated intravascular coagulation</td>
</tr>
<tr>
<td>LDH, bilirubin, and haptoglobin</td>
<td>Check if hemoglobin drops. Elevated LDH and bilirubin levels and decreased haptoglobin level suggest preeclampsia-related microangiopathic hemolytic anemia</td>
</tr>
</tbody>
</table>

ALT = alanine aminotransferase; AST = aspartate aminotransferase; CBC = complete blood count; CrCl = creatinine clearance; FDP = fibrinogen-degradation product; INR = international normalized ratio; LDH = lactic dehydrogenase; PTT = partial thromboplastin time.
## Differential Diagnosis of Hypertension in Pregnancy

<table>
<thead>
<tr>
<th>Disease</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension with no identifiable underlying cause</td>
<td>Hypertension present before conception, before 20 weeks' gestation, and after 12 weeks postpartum. Usually BP is elevated in first 20 weeks of gestation but may be masked by the normal physiologic effects of pregnancy that lower BP in the first two trimesters by as much as 10-15 mm Hg; underlying causes of hypertension should be ruled out by history, physical exam, and appropriate investigations; associated with a 10%-20% risk for preeclampsia; confers little risk in the absence of superimposed preeclampsia</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>Hypertension during pregnancy but with no detectable manifestations of preeclampsia. If present after 20 weeks' gestation, keep close surveillance for the possibility that preeclampsia is developing; may be a harbinger of the eventual development of chronic hypertension</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>Vasospastic disorder associated with endothelial damage that can target brain, lungs, kidney, heart, and liver; usually manifests as elevated BP and proteinuria occurring after 20 weeks' gestation; other manifestations include headache, visual changes, epigastric pain, facial edema, pulmonary edema, seizures, coagulopathy, renal failure, intracerebral hemorrhage, intrauterine growth restriction, and placental abruption. Risk factors include any first pregnancy with a new partner, chronic hypertension, aged younger than 18 or older than 35 years, renal disease, thrombophilias, SLE, and pregestational diabetes; multiple and molar pregnancy</td>
</tr>
<tr>
<td>Chronic hypertension with superimposed preeclampsia</td>
<td>Suspect if BP levels rise after 20 weeks' gestation in previously well-controlled hypertensive patients. Superimposed preeclampsia complicates more than 20% of pregnancies in hypertensive women</td>
</tr>
<tr>
<td>White-coat hypertension</td>
<td>Suspect when the patient reports disparity in measurements of BP between clinical and nonclinical settings; ambulatory BP monitoring may help confirm this diagnosis. Few data exist regarding the incidence of white-coat hypertension and its effect on pregnancy</td>
</tr>
<tr>
<td>Hypertension secondary to hypercortisolism</td>
<td>Muscle weakness, cutaneous striae, easily bruised, impaired glucose tolerance, moon facies, buffalo hump, truncal obesity, plethora of facies, irritability, emotional lability, acne, and hirsutism. Diagnosis confirmed by 24-hour urine test for cortisol or by the administration of a 1-mg overnight dexamethasone suppression test. These tests can be difficult to interpret in pregnancy. Untreated hypercortisolism in pregnancy is rare because it is associated with decreased fertility</td>
</tr>
<tr>
<td>Hypertension secondary to hyperaldosteronism</td>
<td>Muscle weakness, hypokalemia in the setting of low renin levels. Diagnosis confirmed by renin levels that do not increase with volume depletion and aldosterone levels that do not decrease appropriately in response to volume loading; hyperaldosteronism can be partly masked in pregnancy by the effects of high progesterone levels, but manifestations recur postpartum</td>
</tr>
<tr>
<td>Hypertension secondary to pheochromocytoma</td>
<td>Headaches, palpitation, anxiety attacks, unusual sweating, hyperglycemia, and weight loss. Diagnosis confirmed by a serum or 24-hour urine test for catecholamines; associated with a high perinatal morbidity and mortality; pheochromocytoma is a secondary cause of hypertension that represents the highest risk to maternal and fetal health</td>
</tr>
<tr>
<td>Hypertension secondary to renal artery stenosis</td>
<td>Abdominal bruits, elevated creatinine level. Diagnosis confirmed by digital subtraction angiogram during pregnancy; renal artery stenosis is the most common secondary cause of hypertension in this age group</td>
</tr>
<tr>
<td>Hypertension secondary to renal disease</td>
<td>Elevated creatinine and/or BUN levels, proteinuria, red cell casts on microscopic urinalysis, and abdominal mass (polycystic kidney disease).</td>
</tr>
</tbody>
</table>
### Renal insufficiency and/or proteinuria
Renal insufficiency and/or proteinuria may worsen during pregnancy.

<table>
<thead>
<tr>
<th>Hypertension secondary to coarctation of the aorta</th>
<th>Intermittent claudication, decreased or absent lower-limb pulses. Diagnosis confirmed on chest CT or echocardiography; CT should be performed with abdominal shielding during pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension secondary to hyperthyroidism</td>
<td>Suspect if signs or symptoms of hypothyroidism (cold intolerance, hoarse voice, dry hair and skin, delayed relaxation of deep tendon reflexes, bradycardia) or hyperthyroidism (heat intolerance, weight loss, hyperdefecation, warm and moist skin, lid lag, tremor, hyperreflexia). Evaluate thyroid on exam and measure serum TSH and free T4 levels. Remember that TSH can be suppressed normally in the first trimester</td>
</tr>
<tr>
<td>Hypertension secondary to hyperparathyroidism</td>
<td>Often asymptomatic, but ask about polyuria and history of kidney stones. Measure serum calcium level (and correct for serum albumin which is often decreased in pregnancy)</td>
</tr>
<tr>
<td>Hypertension secondary to acromegaly</td>
<td>Coarsened facial features, widened spaces between teeth, deepening voice, increased shoe or glove size, macroGLOSSIA. Clinical suspicion should lead to referral to endocrinologist who will evaluate and possibly screen with a serum insulin-like growth factor</td>
</tr>
</tbody>
</table>

ACE = angiotensin-converting enzyme; BP = blood pressure; BUN = blood urea nitrogen; CT = computed tomography; SLE = systemic lupus erythematosus; T4 = thyroxine; TSH = thyroid-stimulating hormone.
### Drug Treatment for Chronic Hypertension in Pregnancy

<table>
<thead>
<tr>
<th>Drug or Drug Class</th>
<th>Dosing</th>
<th>Side Effects</th>
<th>Precautions</th>
<th>Clinical Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labetalol (Trandate)</td>
<td>100-600 mg bid-tid. Maximum 2400 mg total daily dose</td>
<td>Bradycardia, CNS side effects, bronchospasm, AV block, scalp tingling, diarrhea, nausea. Rare hepatotoxicity</td>
<td>Avoid in asthma. Caution with CKD, hepatic disease, hyperthyroidism, depression</td>
<td></td>
</tr>
<tr>
<td>Nifedipine (Adalat CC, Procardia XL)</td>
<td>20-120 mg qd</td>
<td>Headache, edema, flushing, CNS side effects, GI side effects, rare allergic hepatitis</td>
<td>Avoid concomitant magnesium. Caution with severe bradycardia, HF, hepatic disease, reflux esophagitis, aortic stenosis</td>
<td>Most pregnancy data is from use in the third trimester</td>
</tr>
<tr>
<td>Methyldopa</td>
<td>500 mg bid-qid. Maximum 3000 mg total daily dose</td>
<td>Hypotension, CNS side effects, vertigo, weakness, sodium and fluid retention, GI side effects, xerostomia, nasal congestion. Rare: hemolytic anemia, hepatitis</td>
<td>Caution with blood disorders, CKD, hepatic disease, major depression</td>
<td>The most extensively studied in pregnancy. Up to 15% of women do not tolerate</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>PO: 10-50 mg bid-qid. IV: 6.25 mg slow IV every 20-30 min</td>
<td>Orthostatic hypotension, tachycardia, headache, palpitations, GI side effects, drowsiness, angina, flushing, peripheral edema, lupus-like symptoms, blood dyscrasias</td>
<td>Caution with severe CKD</td>
<td>Most pregnancy data are used after the first trimester</td>
</tr>
</tbody>
</table>

AV = atrioventricular; bid = twice daily; CKD = chronic kidney disease; CNS = central nervous system; CrCl = creatinine clearance; GI = gastrointestinal; HF = heart failure; IM = intramuscular; IV = intravenous; PO = oral; q12hr = every 12 hours; qd = once daily; qid = four times daily; SC = subcutaneous; tid = three times daily.

PIER provides key prescribing information for practitioners but is not intended to be a source of comprehensive drug information.