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Foreword

Blood pressure has been of interest for centuries. In 1733, the English clergyman and natural philosopher Stephen Hales performed the first known direct measurement of blood pressure by inserting a tube into the artery of a horse and measuring how high the blood level rose. In the late 1800s, the sphygmomanometer was introduced into clinical medicine. In the early 1900s, blood pressure measurements began to be used in physical examinations for life insurance, as the link between hypertension and cardiovascular disease became apparent.\(^1\)

Although lifestyle interventions were somewhat effective in managing hypertension, most early drugs were not well tolerated, and skeptics questioned the need to measure or manage blood pressure. In the 1940s and 1950s, surgical approaches, such as sympathectomy and adrenalectomy, were tried but with minimal success. Thiazide diuretics were introduced in 1958, followed by beta blockers, angiotensin-converting enzyme inhibitors, and calcium channel blockers in the 1970s. Next came angiotensin II receptor blockers starting in 1993, and direct renin inhibitors in 2000.\(^1\)

Just as our understanding of hypertension and the risks and benefits of various therapies have evolved over time, so have blood pressure goals. **Section One** of this edition discusses the blood pressure goals proposed in recent guidelines and provides an overview of current evidence-based approaches to treatment. **Section Two** distinguishes between hypertensive emergencies and asymptomatic severe hypertension, and discusses how they should be managed. **Section Three** focuses on strategies for management of resistant hypertension. I was interested to read that the Dietary Approaches to Stop Hypertension (DASH) diet combined with low sodium intake can be as effective as a single antihypertensive drug in reducing blood pressure. **Section Four** discusses hypertension in older adults and emphasizes the importance of individualizing treatment and avoiding overtreatment.

Readers, when you submit your posttest answers, please take a moment to provide feedback and give us your ideas for topics you would like to see covered in future editions. If you are interested in writing for us, visit our website, where calls for authors are posted 3 times each year: http://www.aafp.org/cme/subscriptions/fp-essentials/authors.html.

Karl T. Rew, MD, Associate Medical Editor
Assistant Professor, Departments of Family Medicine and Urology
University of Michigan Medical School, Ann Arbor

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**Learning Objectives**

1. State the recommended frequencies for hypertension screening in adults.
2. List recommended methods to confirm the diagnosis of hypertension before starting antihypertensive therapy.
3. Describe the differences among the major hypertension management guidelines.
4. Distinguish between hypertensive emergency and asymptomatic severe hypertension.
5. Summarize management of asymptomatic severe hypertension in the outpatient setting.
6. List the common etiologies of resistant hypertension.
7. List the common secondary etiologies of hypertension.
8. Describe the risks and benefits of various blood pressure goals when selecting treatment options for older adults with hypertension.
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FP Essentials™ Editorial Mission and Policies

**FP Essentials** is an editorially independent, peer-reviewed publication of the American Academy of Family Physicians (AAFP). It, and its derivative product **FP Comprehensive™**, are produced to assist family physicians and other learners in meeting their continuing medical education (CME), practice, and board certification goals.

**Editorial Mission**

The mission of **FP Essentials** is to provide practicing family physicians, family medicine residents, and other clinicians and trainees with high-quality, cost-effective educational content that emphasizes new advances in clinical practice.

**Objectives**

1. To provide learners with information on advances in clinical practice to aid them in providing up-to-date care for their patients.
2. To assist learners in preparing for the American Board of Family Medicine (ABFM) certification and recertification examinations. Each monthly edition of **FP Essentials** is part of a 9-year curriculum that presents topics with areas of emphasis similar to those on the ABFM examinations.
3. To provide learners with content that meets their CME needs and requirements.
4. To present the content of **FP Essentials** in both print and online formats, thus enabling learners to have access to information anywhere, anytime.

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A minimum competency level (ie, score) of 80% must be met, as directed by the AAFP Commission on Continuing Professional Development. The online quiz tool will provide immediate feedback and an opportunity to answer the question again if needed.

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Pretest Questions

1. According to US Preventive Services Task Force recommendations, hypertension screening should be performed every 3 to 5 years for which one of the following patients with no additional risk factors?
   - A. A 30-year-old with a blood pressure (BP) level of 120/80 mm Hg and normal weight.
   - B. A 30-year-old with a BP level of 130/85 mm Hg and normal weight.
   - C. A 30-year-old with a BP level of 120/80 mm Hg and overweight.
   - D. A 40-year-old with a BP level of 120/80 mm Hg and normal weight.

2. Which one of the following drugs would be the best option for treatment of a woman with hypertension who becomes pregnant?
   - A. Aliskiren (a direct renin inhibitor).
   - B. Labetalol (an alpha and beta blocker).
   - C. Lisinopril (an angiotensin-converting enzyme inhibitor).
   - D. Valsartan (an angiotensin II receptor blocker).

3. In which one of the following hypertensive emergencies is it appropriate to not lower the blood pressure level?
   - A. Acute congestive heart failure.
   - B. Acute ischemic stroke.
   - C. Acute kidney injury.
   - D. Acute myocardial infarction.

4. A hospitalized patient has a persistently elevated blood pressure level of 190/110 mm Hg but no symptoms or evidence of organ damage. Which one of the following management approaches is appropriate?
   - A. Administration of intravenous labetalol.
   - B. Administration of sublingual nifedipine.
   - C. Admission to the intensive care unit.
   - D. Prescription of a long-acting, oral antihypertensive drug.

5. An asymptomatic 55-year-old woman consistently takes three appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. The blood pressure level is 155/90 mm Hg. Which one of the following is the current diagnosis?
   - A. Controlled hypertension.
   - B. Hypertensive emergency.
   - C. Refractory hypertension.
   - D. Resistant hypertension.

6. Which one of the following secondary etiologies of resistant hypertension is rare?
   - A. Obstructive sleep apnea.
   - B. Pheochromocytoma.
   - C. Primary aldosteronism.
   - D. Renal artery stenosis.

7. Results of one study showed a significant increase in the rate of cardiovascular mortality among patients when diastolic blood pressure levels were lower than or equal to which one of the following?
   - A. 60 mm Hg.
   - B. 70 mm Hg.
   - C. 80 mm Hg.
   - D. 90 mm Hg.

8. For orthostatic hypotension to be diagnosed, how much does the blood pressure (BP) level need to decrease after 3 minutes of quiet standing?
   - A. 5 mm Hg or greater in diastolic BP.
   - B. 10 mm Hg or greater in diastolic BP.
   - C. 10 mm Hg or greater in systolic BP.
   - D. 15 mm Hg or greater in systolic BP.
Question 1: The correct answer is A.
The US Preventive Services Task Force recommends annual hypertension screening for adults 40 years and older and for patients at increased risk of hypertension, which includes patients with blood pressure levels of 130 to 139/85 to 89 mm Hg, who are overweight or obese, or who are African American. Adults ages 18 to 39 years with blood pressure levels lower than 130/85 mm Hg who do not have additional risk factors should be screened every 3 to 5 years. See page 11.

Question 2: The correct answer is B.
Women with hypertension who become pregnant should be transitioned to methyldopa, nifedipine, and/or labetalol during pregnancy. See Table 2.

Question 3: The correct answer is B.
In a patient with acute ischemic stroke, the blood pressure (BP) level typically should not be lowered. A neurology subspecialist should be consulted immediately to determine whether the patient is a candidate for thrombolytic therapy, which first may require gradual BP level lowering. See page 17.

Question 4: The correct answer is D.
Patients with persistently elevated blood pressure levels in the hospital setting should be treated as having uncontrolled hypertension, with initiation of an antihypertensive drug, titration of the current drug dosage, or the addition of a long-acting, oral antihypertensive drug and follow-up with the family physician after hospital discharge. See page 19.

Question 5: The correct answer is D.
Resistant hypertension is defined as a blood pressure level above the goal level despite use of a combination of three or more appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. See page 20.

Question 6: The correct answer is B.
Secondary etiologies are more common in patients with resistant hypertension. Even among patients with resistant hypertension, some etiologies such as hyperadrenocorticism (Cushing syndrome) and pheochromocytoma are rare. See page 22 and Table 6.

Question 7: The correct answer is A.
One study found that diastolic blood pressure levels of 60 mm Hg or lower were associated with increased rates of cardiovascular and all-cause mortality. See page 27.

Question 8: The correct answer is B.
Orthostatic hypotension is diagnosed when there is a 20 mm Hg or greater decrease in the systolic blood pressure (BP) level or a 10 mm Hg or greater decrease in the diastolic BP level after 3 minutes of quiet standing. See page 28.
Key Practice Recommendations

1. Screen all adults 18 years and older for high blood pressure (BP).

2. In addition to measurements of BP levels in the office or clinical setting, measurements may be obtained outside of the clinical setting (using ambulatory or home BP monitoring) to confirm the diagnosis of hypertension before starting antihypertensive treatment.

3. For adults with confirmed hypertension and known cardiovascular disease (CVD) or a 10-year atherosclerotic CVD (ASCVD) event risk of 10% or greater, set a BP goal of less than 130/80 mm Hg. For adults with confirmed hypertension without additional markers of increased ASCVD risk, a BP level goal of less than 130/80 mm Hg may be reasonable.

4. Have patients with markedly elevated BP levels and acute organ injury (ie, hypertensive emergency) admitted to the intensive care unit of a hospital for treatment.

5. In patients with resistant hypertension, consider screening for primary hyperaldosteronism and obstructive sleep apnea.

6. For older adults (ie, 65 years or older) with hypertension and a high burden of comorbidity and limited life expectancy, use clinical judgment, patient preference, and a team-based approach to assess the risks and benefits when making decisions about the intensity of BP level lowering and the choice of antihypertensive drugs.

Evidence Ratings and Sources

1. Evidence rating: SORT A

2. Evidence rating: SORT A

3. Evidence rating: SORT B
   Source: Hypertension, reference 9.
   Website: http://hyper.ahajournals.org/content/early/2017/11/10/HYP.0000000000000065

4. Evidence rating: SORT C
   Source: Hypertension, reference 9.
   Website: http://hyper.ahajournals.org/content/early/2017/11/10/HYP.0000000000000065

5. Evidence rating: SORT C
   Sources: J Am Board Fam Med, J Clin Endocrinol Metab, references 38 and 55.

6. Evidence rating: SORT C
   Source: Hypertension, reference 9.
   Website: http://hyper.ahajournals.org/content/early/2017/11/10/HYP.0000000000000065
Strength of Recommendation Taxonomy (SORT)

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<td>A</td>
<td>• Recommendation based on consistent and good-quality patient-oriented evidence.(^a)</td>
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<tr>
<td>B</td>
<td>• Recommendation based on inconsistent or limited-quality patient-oriented evidence.(^a)</td>
</tr>
<tr>
<td>C</td>
<td>• Recommendation based on consensus, usual practice, opinion, disease-oriented evidence,(^a) or case series for studies of diagnosis, treatment, prevention, or screening.</td>
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\(^a\) Patient-oriented evidence measures outcomes that matter to patients: morbidity, mortality, symptom improvement, cost reduction, and quality of life. Disease-oriented evidence measures intermediate, physiologic, or surrogate end points that may or may not reflect improvement in patient outcomes (e.g., blood pressure, blood chemistry, physiologic function, pathologic findings).


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Case 1. Ron is a 36-year-old black man who comes to your office for a preemployment physical examination. He reports feeling well, has no significant medical history, takes no drugs, and is not overweight. He does not smoke, rarely drinks alcohol, and exercises 3 days/week by lifting weights. His blood pressure (BP) level in your office is 155/87 mm Hg.

Hypertension affects at least 1 in 3 American adults and is a major contributor to premature mortality. Current guidelines recommend screening all adults for hypertension. Ambulatory blood pressure (BP) monitoring should be used to confirm the diagnosis of hypertension for most adults before starting antihypertensive drugs. Ambulatory BP monitoring is the preferred method but home BP monitoring is an acceptable alternative. Management of hypertension substantially reduces the risk of heart failure, stroke, and myocardial infarction. Recommended lifestyle modifications include weight loss for overweight or obese patients, regular exercise, the Dietary Approaches to Stop Hypertension (DASH) diet, reduced dietary sodium intake, and reduced alcohol intake. Most hypertensive patients will need at least two drugs to control BP. Although not endorsed by the American Academy of Family Physicians, recent guidelines from the American College of Cardiology and American Heart Association state that a BP level goal of less than 130/80 mm Hg for adults with confirmed hypertension and without additional markers of increased atherosclerotic cardiovascular disease (ASCVD) risk may be reasonable. Decisions regarding when to start antihypertensive drugs are based in part on cardiovascular risk.

Screening

The current USPSTF recommendation on high BP was released in October 2015, and it reaffirmed the previous grade A recommendation to screen all adults 18 years and older for high BP.\(^5\)\(^10\) The USPSTF recommends annual hypertension screening for adults 40 years and older and for patients at increased risk of hypertension, which includes patients with BP levels of 130 to 139/85 to 89 mm Hg, who are overweight or obese, or who are African American.\(^5\) Adults ages 18 to 39 years with BP levels lower than 130/85 mm Hg who do not have additional risk factors should be screened every 3 to 5 years.\(^5\)

A patient with a markedly elevated BP level, as measured in a clinical setting, who has hypertension-related organ damage (eg, left ventricular hypertrophy,
lacunar infarcts) can be diagnosed with hypertension without follow-up BP measurements. For most other patients, diagnosis should be based on at least two elevated BP level measurements on two occasions.\(^9\)

When an elevated BP level is measured during an initial visit, the level should be confirmed at a follow-up visit, preferably with at least two measurements.

Measurements of BP in the clinical setting are prone to technical error, and BP level thresholds have been shown to have poor overall sensitivity and specificity for the diagnosis of hypertension in this setting.\(^11\)

Therefore, when the need for antihypertensive therapy is not clear, ambulatory BP monitoring (ABPM) should be used to confirm the diagnosis.\(^5\)

This recommendation is based on a systematic review that evaluated the diagnostic and predictive accuracy of different BP measurement methods.\(^11\) Use of ABPM permits recognition of white coat hypertension (ie, elevated BP level that occurs only in clinical settings), for which the evidence shows that management is not needed.\(^12\) Elimination of the misdiagnosis of patients with white coat hypertension as having true (or sustained) hypertension can prevent unnecessary drug treatment in a large number of patients.

A cost-effectiveness study, which used a Markov model to simulate a hypothetical population of adults 40 years and older, showed ABPM was the most cost-effective strategy for diagnosis of hypertension. Compared with BP level assessments in the clinical setting, ABPM was found to be cost-saving for all groups, and resulted in more quality-adjusted life-years for men and women older than 50 years.\(^13\) Automated BP level measurements in the clinical setting may be an alternative to ABPM.\(^14\)

Ambulatory BP monitoring is more accurate than clinical BP measurement in predicting cardiovascular events and mortality.\(^15,16,17\) In one study, baseline 24-hour ABPM was performed on 1,187 patients with essential hypertension who were not receiving therapy and 205 healthy normotensive patients. The prevalence of white coat hypertension was 19.2%.\(^15\)

Over a mean follow-up period of 3.2 years, the number of combined fatal and nonfatal cardiovascular events per 100 patient-years was lowest in the sustained normotensive group (0.47) and in the white coat hypertension group (0.49). Among patients with daytime ambulatory hypertension, the event rate was 1.79 per 100 patient-years. For patients with 24-hour hypertension, the event rate was 4.99.\(^15\)

Morbidity did not differ between the normotensive and white coat hypertension groups (\(P=.83\)) after adjustment for traditional risk markers of CVD. Relative to patients with white coat hypertension, cardiovascular morbidity was higher in patients with daytime ambulatory hypertension (relative risk [RR] = 3.70; 95% CI = 1.13 to 12.5), and even higher in patients with 24-hour hypertension (RR = 6.26; 95% CI = 1.92 to 20.32).\(^15\)

Among 808 participants in the Systolic Hypertension in Europe (Syst-Eur) trial, baseline clinical BP levels were compared with 24-hour ambulatory BP levels using a mean of 6 readings. After adjustment for sex, age, previous cardiovascular complications, smoking, and place of residence, at a median follow-up of 4.4 years, a 10-mm Hg higher clinical systolic BP level at baseline was not associated with a worse prognosis but a 10-mm Hg higher 24-hour ambulatory BP level was associated with an increased risk of most outcome measures (eg, hazard ratio [HR] = 1.23; 95% CI = 1.00 to 1.50 for total mortality; HR = 1.34; 95% CI = 1.03 to 1.75 for cardiovascular mortality).\(^16\)

In a much larger study, 5,292 initially untreated hypertensive patients had baseline clinical and ambulatory BP levels measured and were monitored over a median time of 8.4 years. Higher mean values for ambulatory BP level were shown to be predictors of cardiovascular mortality after adjustment for sex, age, risk indices, and, most notably, clinical BP level.\(^17\)

Although the USPSTF states that ABPM is the preferred method to confirm the diagnosis of hypertension, the guidelines state that home BP monitoring may be an acceptable alternative.\(^5\) For home BP monitoring, physicians should ensure that patients use appropriate technique and a systematic approach (Table 1).

Case 1, cont’d. You read in Ron’s patient record that 2 years ago the BP level was 147/82 mm Hg, and you advised him to follow the Dietary Approaches to Stop Hypertension (DASH) diet and start regular exercise. Near the end of the visit today, the BP level is 144/83 mm Hg. You arrange for 24-hour ambulatory BP monitoring.

Management

Lifestyle Modification Recommendations

Several lifestyle modifications have been shown to reduce BP levels and are recommended as part of the management of patients with hypertension.\(^2,18\) These recommendations include weight loss for overweight or obese patients, regular exercise, the Dietary

\[^{11}\] This recommendation is based on a systematic review that evaluated the diagnostic and predictive accuracy of different BP measurement methods. The evidence shows that management is not needed.

\[^{12}\] Elimination of the misdiagnosis of patients with white coat hypertension as having true hypertension can prevent unnecessary drug treatment in a large number of patients.

\[^{13}\] Automated BP level measurements in the clinical setting were compared with 24-hour ambulatory BP levels using a mean of 6 readings. After adjustment for sex, age, previous cardiovascular complications, smoking, and place of residence, at a median follow-up of 4.4 years, a 10-mm Hg higher clinical systolic BP level at baseline was not associated with a worse prognosis but a 10-mm Hg higher 24-hour ambulatory BP level was associated with an increased risk of most outcome measures (eg, hazard ratio [HR] = 1.23; 95% CI = 1.00 to 1.50 for total mortality; HR = 1.34; 95% CI = 1.03 to 1.75 for cardiovascular mortality).

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\[^{18}\] Several lifestyle modifications have been shown to reduce BP levels and are recommended as part of the management of patients with hypertension. These recommendations include weight loss for overweight or obese patients, regular exercise, the Dietary Approaches to Stop Hypertension (DASH) diet, and other lifestyle changes such as increased physical activity, weight loss, and moderation of alcohol intake.
Approaches to Stop Hypertension (DASH) diet, reduced dietary sodium intake, and reduced alcohol intake. However, some patients are unable to initiate and maintain behavioral changes, particularly in unsupportive environments.

**JNC 8 Panel Recommendations**

The panel members appointed to the JNC 8 issued a hypertension management guideline in 2014. Based on a review of the evidence available at the time, the panel issued a grade A recommendation for the general population 60 years or older to start pharmacotherapy to lower BP at a systolic level of 150 mm Hg or higher or a diastolic level of 90 mm Hg or higher, and to achieve a goal level of less than 150/90 mm Hg.

For patients younger than 60 years, the recommendation is to start pharmacotherapy to lower diastolic BP at a level of 90 mm Hg or higher and achieve a goal of less than 90 mm Hg. For systolic BP, the recommendation is to start pharmacotherapy at a level of 140 mm Hg or higher and target a goal of less than 140 mm Hg. In adults with diabetes or chronic kidney disease, initiation of pharmacotherapy is recommended at a systolic level of 140 mm Hg or higher or a diastolic level of 90 mm Hg or higher, and a goal level of less than 140/90 mm Hg is recommended.

**Case 1, cont’d.** For Ron, the ambulatory 24-hour average BP level is 137/82 mm Hg (the cutoff for a controlled 24-hour average level is less than 130/80 mm Hg), with an average daytime level of 141/84 mm Hg. You obtain a basic metabolic panel and a lipid panel to assess for comorbidities. After explaining to Ron the goals of therapy and the importance of decreasing the BP level to prevent cardiovascular events, you prescribe amlodipine 5 mg/day.

**Systolic Blood Pressure Intervention Trial (SPRINT)**

After the release of the JNC 8 guidelines, the Systolic Blood Pressure Intervention Trial (SPRINT) was published. This trial randomized 9,361 hypertension patients to a systolic BP level goal of less than 120 mm Hg with intensive management, or less than 140 mm Hg with standard management.

Patients were 50 years and older, with a systolic BP of 130 to 180 mm Hg, and had established CVD (20% of the participants) or an increased risk of CVD (76% of participants had a 10-year CVD risk score of 15% or greater). None of the patients had diabetes. The primary composite outcome was myocardial infarction, other acute coronary syndrome, stroke, heart failure, or death from cardiovascular causes. At baseline, 91% of participants were taking one or more antihypertensive drug, and the mean BP level was 140/78 mm Hg, with a systolic BP level less than 145 mm Hg in approximately two-thirds of patients.

At the 1-year SPRINT follow-up, the mean systolic BP level was 121 mm Hg in the intensive treatment group and 136 mm Hg in the standard treatment group. The trial was discontinued early after a median follow-up of approximately 3.3 years because a significantly lower rate of the primary composite outcome was observed in the intensive treatment group compared with the standard treatment group (1.65% versus 2.19% per year; HR = 0.75; 95% CI = 0.64 to 0.89). The all-cause mortality rate was 27% lower for the intensive treatment group compared with that for the standard treatment group. Overall rates of adverse effects were similar between groups but rates of some serious adverse events (eg, hypotension, syncope, electrolyte abnormalities, acute kidney injury) were higher in the intensive treatment group.

Clinical BP levels in the SPRINT were measured using an automated measurement system. An automated monitor was preset to wait 5 minutes before BP mea-

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**Table 1**

**Home Blood Pressure Monitoring Protocol**

| Use a cuff of the correct size and appropriate positioning and technique |
| Measure home blood pressure 6 times/day for 5 consecutive days: |
| Perform 3 morning and 3 evening consecutive measurements |
| Perform measurements approximately 1 minute apart without removing the cuff |
| Record dates and times of all measurements (or preferably use an electronic device to record measurements) |
| Discard the measurements from the first 2 days and discard the first measurement of each set of 3 measurements |
| Average the remaining measurements |

Hypertension Update

surement and to take and average 3 consecutive measurements without an observer present. This strategy has been shown to help mitigate the effects of white coat hypertension.\(^{14,20}\)

Use of this approach may explain the lower BP levels measured in SPRINT, and may not reflect the standard approach to clinical BP measurement in a busy family medicine practice. The setting of lower BP goals may result in overtreatment of some patients if BP levels are not measured accurately. Of note, the 2016 guidelines from the Canadian Hypertension Education Program Guidelines Task Force now recommend automated office BP measurement as the clinical technique of choice for assessing BP levels.\(^{21}\)

Overall, SPRINT showed that for a group of non-diabetic patients older than 50 years and at increased risk of CVD or with established CVD, a lower BP level goal (when BP levels are measured accurately) reduced the rate of cardiovascular events.\(^{19}\) However, these findings may not be applicable for most patients with hypertension in the family medicine setting. An analysis of National Health and Nutrition Examination Survey (NHANES) data found that approximately 16.7% of patients receiving treatment for hypertension would meet the SPRINT qualifying criteria.\(^{18}\) Such patients are more likely to be older, male, and non-Hispanic white individuals.

**ACP/AAFP Guideline**

In January 2017, the ACP and AAFP published a guideline for the management of hypertension in patients 60 years and older.\(^{7}\) This guideline is based on a systematic evidence review. The authors found that strong evidence supports the treatment of patients 60 years or older with persistent systolic BP levels of 150 mm Hg or higher to achieve a systolic BP level goal of less than 150 mm Hg. The management of hypertension in older adults is discussed in detail in **Section Four**.

**ASH/ISH Guideline**

The ASH and ISH developed a guideline designed to meet the practical needs of clinicians caring for patients with hypertension across a broad range of international communities. This 2014 guideline recommends a BP level goal of less than 140/90 mm Hg for most adults and offers recommendations that address the full spectrum of hypertension management.\(^{8}\)

**ACC/AHA Guideline**

In November 2017, the ACC and AHA, along with nine other health professional organizations, released a guideline for the prevention, detection, evaluation, and management of high BP in adults. The major change in this guideline is the redefinition of hypertension as a BP level of 130 mm Hg systolic or higher or 80 mm Hg diastolic or higher. The guideline eliminates the prehypertension category and defines a normal BP level as lower than 120/80 mm Hg and an elevated BP level as 120 to 129 mm Hg systolic and less than 80 mm Hg diastolic.\(^{9}\) Table 2 summarizes the major recommendations.

In December 2017, the AAFP decided not to endorse the ACC/AHA guideline. However, it does continue to endorse the JNC 8 guidelines.\(^{22}\)

**Case 1, cont’d.** One month later, Ron returns for a follow-up visit. The BP level is 128/78 mm Hg. Results of the basic metabolic panel and lipid panel are normal. You advise him to continue taking amlodipine 5 mg/day and ask him to schedule a visit in 6 to 12 months.
Table 2
Recommendations From the 2017 ACC/AHA Guideline on High Blood Pressure in Adults

BP level categories are: normal (<120/80 mm Hg); elevated (120 to 129 mm Hg systolic and <80 mm Hg diastolic); stage 1 hypertension (130 to 139 mm Hg systolic or 80 to 89 mm Hg diastolic); and stage 2 hypertension (≥140 mm Hg systolic or ≥90 mm Hg diastolic).

Use out-of-office BP measurements to confirm the diagnosis of hypertension and to adjust drug dosages.

For adults with confirmed hypertension and known CVD or a 10-year ASCVD event risk ≥10%, a BP level goal of <130/80 mm Hg is recommended. For adults with confirmed hypertension without additional markers of increased ASCVD risk, a BP level goal of <130/80 mm Hg may be reasonable.

Initiate antihypertensive drug therapy with two first-line drugs of different classes for adults with stage 2 hypertension and an average BP level more than 20/10 mm Hg higher than the goal. It is reasonable to initiate therapy with a single drug for adults with stage 1 hypertension and a BP goal of less than 130/80 mm Hg.

Use effective behavioral and motivational strategies to help adults with hypertension achieve healthy lifestyles.

After initial BP level evaluation, treat adults with an elevated BP level or stage 1 hypertension who have an estimated 10-year ASCVD risk <10% with nonpharmacologic therapy and follow up in 3 to 6 months. For adults with stage 1 hypertension and a 10-year ASCVD risk ≥10%, or adults with stage 2 hypertension, treat with a combination of nonpharmacologic therapy and drug therapy, and follow up in 1 month. Adults with a very high average BP level should be evaluated and promptly started on drug treatment.

Use antihypertensive drugs in patients with clinical CVD (eg, coronary heart disease, heart failure, stroke) who have an average BP level ≥130/80 mm Hg. For most patients with comorbidities, the BP treatment goal should be <130/80 mm Hg. For patients age 65 years or older with an average systolic BP level of ≥130 mm Hg, or for patients with heart failure, a systolic BP level goal of <130 mm Hg is recommended.

In black adults with hypertension but without heart failure or chronic kidney disease, initial treatment should include a thiazide diuretic or calcium channel blocker. Two or more antihypertensive drugs are recommended to achieve a BP level goal of less than 130/80 mm Hg in most adults with hypertension, particularly in black adults with hypertension.

Women with hypertension who become pregnant should be transitioned to methyldopa, nifedipine, and/or labetalol during pregnancy. Women with hypertension who become pregnant should not be treated with ACE inhibitors, ARBs, or direct renin inhibitors.

Use a team-based care approach in the treatment of adults with hypertension. Use electronic health records and patient registries to identify undiagnosed or undertreated patients and to guide efforts to improve hypertension control.

ACC = American College of Cardiology, ACE = angiotensin-converting enzyme; AHA = American Heart Association; ARB = angiotensin II receptor blockers; ASCVD = atherosclerotic cardiovascular disease; BP = blood pressure; CVD = cardiovascular disease.

Hypertensive Emergency and Asymptomatic Severe Hypertension

Hypertensive emergency occurs when the blood pressure (BP) level is severely elevated (ie, higher than 180 mm Hg systolic or higher than 120 mm Hg diastolic) and acute organ damage is present. Patients with hypertensive emergencies are treated initially in the emergency department and then admitted to the intensive care unit. Management is directed at the specific situation, with the rate and extent of BP level lowering tailored to the type and extent of organ damage. Patients with severely elevated BP level but without symptoms have asymptomatic severe hypertension. Most such patients have chronic hypertension. Management of asymptomatic severe hypertension starts (or restarts) with long-acting antihypertensive drugs, typically a combination of a renin-angiotensin system inhibitor, a thiazide diuretic, and/or a calcium channel blocker. Physicians should emphasize adherence to the drug regimen and monitor patients closely until the goal BP level is achieved.

Case 2. Marjorie is a 64-year-old woman who comes to your office reporting hip pain. Your medical assistant alerts you that Marjorie’s blood pressure (BP) level is 195/90 mm Hg and the pulse is 86 beats/min.

Hypertensive emergency is defined as severely elevated blood pressure (BP) level associated with impending or progressive organ damage. A severely elevated BP level typically is defined as higher than 180 mm Hg systolic or higher than 120 mm Hg diastolic but these thresholds are arbitrary. Most patients with severely elevated BP levels do not have organ damage but have asymptomatic severe hypertension. Hypertensive urgency is an older term that still may be used to refer to asymptomatic severe hypertension in patients at high risk of developing acute organ damage. Hypertensive emergency is rare, but asymptomatic severe hypertension is fairly common.

Hypertensive Emergency

The first step in the treatment of a patient with markedly elevated BP level is to assess for acute organ damage (Figure 1). The two most common types of organ damage in hypertensive emergency are cerebral infarction and acute pulmonary edema. Other types include acute congestive heart failure, acute myocardial infarction, aortic dissection, encephalopathy, and renal failure.

The patient assessment must include a history, physical examination, and tests to evaluate for specific organ damage. Patients with symptoms related to acute organ damage should be treated initially in the emergency department and then admitted to the intensive care unit.

The history should include assessment for neurologic symptoms, including neurologic deficit, vision changes, and altered mental status. Clinicians should ask about recent severe headache, vomiting, or any acute head injury. Chest pain could indicate cardiac ischemia or acute aortic dissection. Dyspnea may be due to pulmonary edema. Clinicians should ask about use of illicit drugs such as cocaine or amphetamines.

Physical examination findings indicative of acute organ damage include papilledema or exudates on ophthalmoscopy, rales suggestive of pulmonary edema, or focal neurologic deficit. When clinically indicated, chest x-ray can help assess the extent of pulmonary edema. When stroke is suspected, brain imaging with computed tomography scan or magnetic resonance imaging study is indicated. If cardiac or cerebral ischemia is suspected, serial troponin level testing and electrocardiography are indicated. Acute kidney injury is assessed by obtaining urinalysis and serum electrolyte and creatinine levels. Suspected acute aortic dissection can be confirmed with contrast-enhanced computed tomography scan or magnetic resonance imaging study of the chest, or with transesophageal echocardiography.

Treatment of a patient with a hypertensive emergency is tailored according to the type and extent of organ damage. The choice of drug varies according to the specific situation (Table 3). The organs of a patient with BP that has reached severe levels have adapted...
over time (i.e., autoregulated), and reduction of the BP level significantly or quickly can be catastrophic.25

In a patient with acute ischemic stroke, the BP level typically should not be lowered. A neurology subspecialist should be consulted immediately to determine whether the patient is a candidate for thrombolytic therapy, which first may require gradual BP level lowering.9,26 In contrast, in a patient with acute aortic dissection, the systolic BP level should be decreased to 120 mm Hg or lower within 20 minutes. In most other situations, the BP level should be decreased by no more than 25% over the first hour, then to 160/100 to 110 mm Hg over the next 2 to 6 hours. The goal BP level then should be achieved in the following 24 to 48 hours.9

Case 2, cont’d. Marjorie reports feeling well. She has no chest pain, dyspnea, or changes in vision or speech. Six months ago, the BP level was 170/78 mm Hg. At that visit, she was taking hydrochlorothiazide 25 mg/day, and your practice partner added amlodipine 10 mg/day to the regimen. Marjorie never filled the prescription for amlodipine and discontinued taking hydrochlorothiazide about 1 month ago. The physical examination results are unremarkable.

Asymptomatic Severe Hypertension

Most patients with elevated BP levels that are considered severe are asymptomatic. Mild symptoms such as headache or light-headedness may be present. Some patients with asymptomatic severe hypertension previously have been diagnosed with hypertension, and have not adhered to their prescribed drug regimen. Asymptomatic severe hypertension is common, with up to 5% of ambulatory patients having a BP level that meets the definition.29

After excluding the presence of acute organ damage that would indicate a hypertensive emergency, it is important to repeat BP level measurements for patients who present with severely elevated BP levels. Appropriate measurement techniques should be used. After a brief rest period (e.g., 30 minutes), the measured BP level may fall below the severe level.30

Patients with resistant hypertension also may have severely elevated BP levels. White coat hypertension may be responsible for at least part of the elevation in BP level. Physicians should consider obtaining ambulatory BP monitoring (ABPM) as part of the evaluation. Studies have shown that up to one-third of patients with apparent resistant hypertension have normal BP levels on ABPM.31

Asymptomatic severe hypertension typically represents poor control of chronic hypertension. Management should be aimed at reducing the BP level gradually, over days.32 Immediate BP level lowering rarely is clinically indicated.33 Sublingual nifedipine should never be used to manage an elevated BP level because it can produce an unpredictable BP level reduction leading to severe ischemic complications.33

Physicians should ask any patient with newly diagnosed hypertension or severe hypertension about use of illicit drugs as well as use of prescription and

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Figure 1. Management of Severe Blood Pressure Elevation

over-the-counter drugs. Cocaine and amphetamines may cause marked elevations in BP levels. Nonsteroidal anti-inflammatory drugs may increase BP levels and reduce the effectiveness of antihypertensive drugs. Patients may not realize that over-the-counter headache powders fall into this category, so physicians may need to ask about them explicitly.\textsuperscript{23}

Physicians also should ask patients about difficulty adhering to the prescribed drug regimen. Nonadherence with antihypertensive treatment is among the most common causes of uncontrolled and severe hypertension.\textsuperscript{23}

In patients with asymptomatic severe hypertension, physical examination findings consistent with a lack of acute organ damage should be documented. The evaluation should focus on ophthalmic, cardiac, pulmonary, and neurologic examinations, assessing for new or acute findings (eg, papilledema, myocardial ischemia, congestive heart failure, rales, neurologic deficit).\textsuperscript{23} The examination should assess for signs of chronic organ damage, such as an accentuated point of maximal impulse (suggestive of left ventricular hypertrophy) or decreased peripheral pulses (suggestive of chronic peripheral vascular disease) due to chronic hypertension.

Laboratory tests and electrocardiography are not needed routinely for patients with asymptomatic severe hypertension. If acute kidney injury is suspected, a serum creatinine level can be obtained and compared with previous creatinine levels. Of note, the American College of Emergency Physicians does not recommend laboratory testing as part of the routine evaluation of patients with asymptomatic severe hypertension.\textsuperscript{34}

One large study examined the outcomes of nearly 59,000 visits for patients who presented with hypertensive urgency in outpatient settings. It found that only 5.5% of the laboratory tests obtained for these patient visits had any abnormal results. Most of the abnormal test results were not due to acute organ damage.\textsuperscript{29}

Table 3

<table>
<thead>
<tr>
<th>Organ Damage</th>
<th>Clinical Features</th>
<th>Drug(s) of Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute congestive heart failure</td>
<td>S\textsubscript{3}, S\textsubscript{4}, jugular venous distention, pulmonary edema</td>
<td>Loop diuretic\textsuperscript{b}, nitroglycerin</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>Chest pain, ischemic changes on electrocardiogram, elevated troponin level</td>
<td>Beta blocker\textsuperscript{b}, nitroglycerin</td>
</tr>
<tr>
<td>Aortic dissection</td>
<td>Sensation of &quot;tearing,&quot; severe chest or back pain, dissection confirmed on imaging</td>
<td>Beta blocker\textsuperscript{c} (eg, esmolol\textsuperscript{c}, labetalol) + nitroprusside; AVOID direct vasodilators (eg, hydralazine)</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>Headache, confusion, nausea, vomiting that may resolve when blood pressure level is lowered</td>
<td>Nicardipine\textsuperscript{c}, fenoldopam, nitroprusside</td>
</tr>
<tr>
<td>Hemorrhagic stroke</td>
<td>Hemorrhage on imaging</td>
<td>Labetalol, nicardipine\textsuperscript{c}</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>Stroke without hemorrhage on imaging</td>
<td>Do not lower blood pressure acutely</td>
</tr>
<tr>
<td>Renal impairment</td>
<td>Acutely elevated creatinine level, microscopic hematuria</td>
<td>Fenoldopam</td>
</tr>
</tbody>
</table>

\textsuperscript{a}In pregnancy, preeclampsia and eclampsia also are hypertensive emergencies (and are a reminder that the 180/120 mm Hg threshold is arbitrary, given that the organ damage can occur at much lower blood pressure levels) but they are not discussed specifically in this edition.

\textsuperscript{b}This is an off-label use of some drugs in this class.

\textsuperscript{c}This is an off-label use of this drug.

ischemic attack, uncontrolled hypertension, hospital admissions) as outcomes. It found that these outcomes were rare (less than 1%) at all time points, and there were no significant differences between patients treated in the hospital setting or continued as outpatients (ie, sent home) at 7 days, 8 to 30 days, or 6 months. Patients who were sent home were more likely to have uncontrolled hypertension at 1 month (86% versus 82%) but not at 6 months (65% versus 67%). Patients who were sent home had lower hospital admission rates at 7 days and at 8 to 30 days compared with patients treated in the hospital. Thus, most patients with hypertensive urgency should be treated on an outpatient basis and not in the emergency department or hospital setting.

Most patients with hypertension with severely elevated BP levels will require at least two drugs from different classes for management. Patients should be advised to resume their previously tolerated, ideally once-a-day antihypertensive drug regimen, or consider starting therapy with a combination of two or more drugs as shown in Table 4. If the BP level goal is not achieved within 1 month of treatment, the dose of the initial drug should be titrated up to the maximum recommended dose. If the BP level goal still is not achieved, an additional drug should be added to the regimen.

Case 2, cont’d. You ask Marjorie if she has been having difficulty with her drugs for BP management. She says she can afford them, but because of the hip pain she neglected to fill the prescriptions. You recommend acetaminophen to manage the hip pain, which is a result of arthritis. She agrees to restart the hydrochlorothiazide and start taking the amlodipine. She schedules a follow-up appointment in 1 week.

For patients with asymptomatic severe hypertension, the BP level should be decreased gradually, over the course of several days to weeks. Aggressive lowering of the BP level can be harmful to patients, resulting in syncope, stroke, or myocardial infarction.

In the setting of persistent markedly elevated BP levels (eg, higher than 240 mm Hg systolic or higher than 130 mm Hg diastolic), it may be prudent to provide initial treatment in the emergency department or hospital setting. In that setting, consider initiating a shorter-acting antihypertensive followed by a long-acting antihypertensive.

Elevated BP levels often are observed in patients hospitalized for other conditions. It is common for physicians to ask to be contacted when the BP level measurements of an inpatient meet the criteria for severe hypertension. However, the common practice of administering short-acting intravenous drugs in such situations is not evidence-based. Instead, patients with persistently elevated BP levels in the hospital setting should be treated as having uncontrolled hypertension, with initiation of an antihypertensive drug, titration of the current drug dosage, or the addition of a long-acting, oral antihypertensive drug and follow-up with the family physician after hospital discharge.

Case 2, cont’d. Marjorie returns 1 week later. She is now taking the drugs as prescribed. The BP level measured in the office is 130/80 mm Hg.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Combination Drug Therapy for Asymptomatic Severe Hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Therapy</td>
<td>Comment</td>
</tr>
<tr>
<td>Thiazide diuretic (preferably chlorthalidone) + calcium channel blocker</td>
<td>These drug classes have been shown to be effective in black patients</td>
</tr>
<tr>
<td>Thiazide diuretic + ACE inhibitor OR ARB</td>
<td>For patients with CKD or HF (patients with HF may require a loop diuretic)</td>
</tr>
<tr>
<td>ACE inhibitor OR ARB + calcium channel blocker</td>
<td>For patients with CKD</td>
</tr>
</tbody>
</table>

*ACE inhibitors, ARBs, and direct renin inhibitors should not be combined.

This is an off-label use of some calcium channel blockers.

ACE = angiotensin-converting enzyme; ARB = angiotensin II receptor blocker; CKD = chronic kidney disease; HF = heart failure.

SECTION THREE
Resistant Hypertension

Resistant hypertension is a blood pressure (BP) level that remains above the goal level despite adherence to at least three appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. Evaluation of suspected resistant hypertension starts with confirming adherence to the drug regimen. White coat hypertension should be ruled out with out-of-office BP level measurements, ideally using 24-hour ambulatory BP monitoring. Obesity, significant alcohol intake, and interfering drugs and other substances can contribute to resistant hypertension. Lifestyle modifications, including exercise and dietary sodium restriction, can be useful in management. Resistant hypertension may be due to secondary etiologies (eg, parenchymal kidney disease, obstructive sleep apnea, hyperaldosteronism). Adequate diuretic treatment is a key part of therapy. In addition to a diuretic, patients with resistant hypertension should take a dihydropyridine calcium channel blocker and an angiotensin-converting enzyme inhibitor or angiotensin II receptor blocker. Spironolactone is an effective fourth drug. Other drug options include a beta blocker, a long-acting non-dihydropyridine calcium channel blocker, or clonidine or guanfacine. When the BP level is not controlled despite adherence to a four-drug regimen, referral to a hypertension subspecialist should be considered.

Case 3. Bart is a 47-year-old black man who has had hypertension for 20 years. He does not smoke, drink alcohol, or use illicit drugs. His drug regimen includes hydrochlorothiazide 25 mg/day, benazepril 20 mg/day, and amlodipine 10 mg/day. The in-office blood pressure (BP) level today is 165/101 mm Hg. The body mass index is 32 kg/m^2. He says he feels well and reports that he has been taking the drugs.

Resistant hypertension is defined as a blood pressure (BP) level that remains above the goal level despite adherence to at least three appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. Patients with controlled hypertension that requires four or more antihypertensive drugs also are considered to have resistant hypertension. Patients with uncontrolled BP levels despite taking five or more antihypertensive drugs have refractory hypertension.

Among drug-treated patients with hypertension in the United States, approximately 13% have resistant hypertension. A Spanish study of resistant hypertension showed a similar rate of 12% in that population.

Only a small percentage of patients with resistant hypertension have refractory hypertension. In the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study, among 2,144 participants classified as having resistant hypertension, 3.6% had refractory hypertension. Therefore, it should be assumed that most patients with resistant hypertension can achieve the goal BP level. Table 5 outlines an approach to the management of resistant hypertension.

Treatment Adherence

An important first step in the evaluation of patients with suspected resistant hypertension is ascertaining adherence to the drug treatment plan. Patients should be asked to bring all drugs to their appointments so that drug lists can be reconciled and dosages

| Table 5 |
| Management of Resistant Hypertension |
| Step 1. Assess and address adherence to therapy |
| Step 2. Rule out measurement error and white coat hypertension |
| Step 3. Consider associated comorbidities |
| Step 4. Reconsider secondary causes |
| Step 5. Address volume overload and interfering substances |
| Step 6. Intensify therapy |
| Step 7. Consider consulting a hypertension specialist |

Section Three

Adherence can be assessed in a nonjudgmental manner, with clinicians asking about difficulties in taking drugs daily and missed doses. Adverse effects may contribute to poor adherence. Helping patients understand and minimize potential adverse effects may help improve adherence.

A once-a-day drug regimen can improve patient adherence, and prescribing of fixed-dose combination pills also may improve adherence. Patients may have difficulty affording their drug prescriptions, so prescribing of low-cost regimens can be important. Some patients may not understand their drug regimens due to poor health literacy or cultural or language barriers, so regimens should be simplified, if possible.

**White Coat Hypertension**

Appropriate in-office BP level measurement technique requires that the patient be positioned correctly and not talking after at least a 5-minute rest. An appropriately sized cuff should be used. For obese patients with large arms, use of a thigh cuff may be required.

White coat hypertension should be considered when the in-office BP level remains elevated despite adherence to a multiple-drug regimen. Approximately 33% of patients who appear to have resistant hypertension actually have controlled BP levels when levels are measured outside the office.

One study enrolled 611 patients with uncontrolled in-office BP levels, defined for the study as 140 mm Hg systolic or higher or 90 mm Hg diastolic or higher. It found that approximately 40% of patients taking one or two drugs and approximately 30% of patients taking three drugs had controlled BP levels as measured by ambulatory BP monitoring (ABPM). In a study of more than 8,200 patients with resistant hypertension, 38% had controlled BP levels based on 24-hour ABPM. Treatment of white coat hypertension inadvertently may lead to side effects such as hypotension.

White coat hypertension may be addressed with use of automated clinical devices that measure BP levels at serial intervals without a clinician present. Although these devices are not common in the United States, use of them is increasing.

White coat hypertension is common among patients with suspected resistant hypertension, so out-of-office BP level measurements should be used to clarify the diagnosis. Use of 24-hour ABPM is ideal. Home BP monitoring is an alternative when ABPM is not readil available. Before relying on home BP level measurements, physicians should ensure that patients have appropriately sized cuffs and are using appropriate technique. Patients should be instructed on obtaining home BP level measurements and should use a systematic approach in collecting measurements.

One approach is to use home BP monitoring initially, and change to 24-hour ABPM if measurements suggest the presence of white coat hypertension. If the ABPM average shows elevated BP levels, therapy should be intensified. If the ABPM average shows elevated BP levels, therapy should be intensified.

**Figure 2. Ruling Out White Coat Hypertension in Patients With Suspected Resistant Hypertension**

If ABPM is not readily available, home BP monitoring can be used as an initial strategy. If home BP monitoring confirms the BP level is above goal, no additional testing is needed. If home BP monitoring suggests white coat hypertension, ABPM can be used to confirm.

ABPM = ambulatory blood pressure monitoring; BP = blood pressure.

controlled BP levels (ie, average <130/80 mm Hg), the current treatment is continued.38

Case 3, cont’d. Near the end of the visit, Bart’s BP level remains elevated at 157/94 mm Hg. You reiterate the importance of adhering to the drug treatment plan and explain that a goal of BP control is to prevent cardiovascular events such as myocardial infarction and stroke. To ensure that the BP level elevation is not due to white coat hypertension, you arrange for 24-hour ambulatory BP monitoring.

Comorbidities
Resistant hypertension tends to be associated with certain comorbidities. BP levels may be more challenging to control in patients who are obese due to increased retention of sodium and fluid.46,47 These patients often require higher doses of antihypertensive drugs.38 Weight loss can be an effective adjunct in achieving BP level control, and should be emphasized. On average, the systolic BP level is reduced by about 1 to 2 mm Hg for every 1 kg (2.2 lb) of weight loss.47

Chronic kidney disease (CKD) may be the result of hypertension and is additionally problematic. It makes hypertension more resistant to management due to increased sodium and fluid retention.46 Reduction in dietary sodium intake is an important component of management in patients with CKD, and adequate diuretic treatment is key for BP control.38

An angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) should be prescribed for patients with albuminuria greater than 30 mg/g in 24 hours.38 Serum potassium levels and the glomerular filtration rate should be monitored. ACE inhibitors, ARBs, and direct renin inhibitors should not be used in combination.49

Secondary Etiologies
Secondary etiologies of hypertension should be considered for all patients with newly diagnosed hypertension. These etiologies are more common in patients with resistant hypertension. When hypertension is determined to be resistant, possible secondary etiologies should be reassessed (Table 6). Obstructive sleep apnea, primary aldosteronism (Conn syndrome), and renal artery stenosis are the most common secondary etiologies. Even among patients with resistant hypertension, some etiologies such as hyperadrenocorticism (Cushing syndrome) and pheochromocytoma are rare.38

Obstructive Sleep Apnea
Obstructive sleep apnea (OSA) is common among patients with resistant hypertension. OSA should be suspected in obese patients and in patients who report a history of snoring, witnessed apnea, or excessive daytime sleepiness. Resistant hypertension may be the only sign of OSA.38

In one study using polysomnography, four out of five patients with resistant hypertension were diagnosed with unsuspected OSA.50 Given the high prevalence of OSA in patients with resistant hypertension, polysomnography or home sleep testing should be considered as part of the evaluation. If OSA is diagnosed, an additional benefit of treatment with continuous positive airway pressure is that it can improve BP control.51

Primary Aldosteronism
Up to 20% of patients referred to hypertension subspecialty clinics have primary aldosteronism.52,53 A study of 1,616 patients with resistant hypertension found that 182 (11%) had primary aldosteronism. Of that 11%, 83 (46%) were found to have hypoka-
A normal potassium level does not rule out primary aldosteronism. Physicians should assess patients with resistant hypertension for primary aldosteronism using a morning plasma aldosterone-to-renin ratio. A ratio below 20 (with plasma aldosterone reported in ng/dL and plasma renin activity reported in ng/mL/hr) excludes primary aldosteronism. A ratio of 20 or greater with a serum aldosterone level greater than 15 ng/dL is suggestive of primary aldosteronism. However, the diagnosis must be confirmed by a salt suppression test, as approximately half of patients with a high ratio will not have primary aldosteronism.

A patient who meets the diagnostic criteria for primary aldosteronism should be referred to an endocrinology subspecialist for further evaluation and testing. The ideal diagnostic strategy for distinguishing bilateral adrenal hyperplasia from adrenal adenoma has not been established.

Renal Artery Stenosis

Renal artery stenosis due to fibromuscular dysplasia may be a cause of secondary hypertension, particularly among young women. In older adults, renal artery stenosis typically is due to atherosclerosis.

The physical examination of a patient with renal artery stenosis may reveal a high-pitched holosystolic renal artery bruit. Computed tomography angiography can be used to confirm stenosis. Magnetic resonance imaging study with gadolinium might be preferred because it can determine the degree of stenosis without use of radiation. The gadolinium contrast can increase the risk of nephrogenic systemic fibrosis, however. In patients with kidney impairment, magnetic resonance imaging study without gadolinium can be used.

In facilities in which magnetic resonance imaging study and computed tomography scan are not available or in patients in whom they are contraindicated, renal artery duplex Doppler ultrasonography can be used. However, its accuracy may be limited by the skill of the ultrasonographer and patient body habitus.

Older patients with renal artery stenosis due to atherosclerosis may not benefit from revascularization. Thus, detection may not change management. There are exceptions for which revascularization is indicated in the setting of severe renal artery stenosis. Identification of renal artery stenosis caused by fibromuscular dysplasia, typically in younger patients, is important.
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may be needed in patients with a glomerular filtration rate less than 30 mL/min or a serum creatinine level greater than 1.8 mg/dL. Furosemide and bumetanide are short-acting loop diuretics that need to be taken 2 to 3 times/day for this indication. Torsemide may be preferable since it is longer-acting. (Hypertension is an off-label use of bumetanide.)

**Interfering Drugs and Other Substances**

Many drugs and other substances can affect BP control by increasing BP levels or interfering with the effects of antihypertensive drugs (Table 7). For example, nonsteroidal anti-inflammatory drugs enhance sodium retention and can decrease the effectiveness of most antihypertensive drugs. Patients with resistant hypertension should be advised to avoid or strictly limit use of nonsteroidal anti-inflammatory drugs.

Other substances that can interfere with management of resistant hypertension include oral contraceptives, some antidepressants, appetite suppressants, sympathomimetics, and some herbal supplements. Elimination or reduction of the use of these substances can help lower the BP level.

Significant alcohol intake can result in hypertension that is more difficult to control. Patient adherence to advice to reduce alcohol intake is poor. Patients who drink more than 2 standard drinks/day for men or 1 standard drink/day for women should be advised to reduce their intake.

**Case 3, cont’d.** Bart continues to take chlorthalidone, benazepril, and amlodipine. He says he is working on reducing his salt intake. The in-office BP level today is 145/90 mm Hg. When questioned, Bart says his wife tells him that he snores heavily but he is not sure if he ever briefly stops breathing. You obtain polysomnography.

**Treatment Intensification**

In addition to use of antihypertensive drugs, management of resistant hypertension includes lifestyle modifications. In a study of patients with resistant hypertension, patients with a greater number of healthy lifestyle practices had a lower risk of cardiovascular events over a mean follow-up of 4.5 years.

For patients with resistant hypertension, the importance of lifestyle modifications should be re-emphasized and regular physical activity should be encouraged. The Dietary Approaches to Stop Hypertension (DASH) diet combined with low sodium intake can be as effective as a single antihypertensive drug in reducing BP levels. The importance of weight loss should be stressed for overweight and obese patients. Smokers should be strongly encouraged to discontinue smoking, and should be offered cessation drugs or referral to cessation programs.

As discussed previously, fixed-dose combination pills may be useful to enhance adherence to multiple-drug regimens. Unfortunately, chlorthalidone is not available in many combinations that include an ACE inhibitor, ARB, or calcium channel blocker. Spironolactone, an aldosterone antagonist, is an effective fourth drug. It has been shown to reduce the systolic BP level by approximately 20 mm Hg in patients with resistant hypertension. Because aldosterone antagonists are potassium-sparing and can cause hyperkalemia, potassium levels should be monitored in patients taking spironolactone, particularly in patients who also

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**Table 7**

**Drugs and Other Substances That May Interfere With Blood Pressure Control**

<table>
<thead>
<tr>
<th>Substance</th>
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</thead>
<tbody>
<tr>
<td>Alcohol</td>
</tr>
<tr>
<td>Amphetamines</td>
</tr>
<tr>
<td>Antidepressants (eg, bupropion, monoamine oxidase inhibitors, selective serotonin reuptake inhibitors, tricyclic antidepressants, venlafaxine)</td>
</tr>
<tr>
<td>Cocaine</td>
</tr>
<tr>
<td>Corticosteroids</td>
</tr>
<tr>
<td>Cyclosporine</td>
</tr>
<tr>
<td>Decongestants</td>
</tr>
<tr>
<td>Dietary and herbal supplements (eg, bitter orange [Citrus aurantium], ephedra, ginseng [Panax ginseng], ma huang)</td>
</tr>
<tr>
<td>Diet pills</td>
</tr>
<tr>
<td>Erythropoietin</td>
</tr>
<tr>
<td>Licorice (Glycyrrhiza glabra) (including some types of chewing tobacco)</td>
</tr>
<tr>
<td>Nonsteroidal anti-inflammatory drugs (including cyclooxygenase-2 inhibitors)</td>
</tr>
<tr>
<td>Oral contraceptives</td>
</tr>
</tbody>
</table>

are taking an ACE inhibitor or ARB.\textsuperscript{38}

High doses of spironolactone can cause gynecomastia in men. Eplerenone is an alternative to spironolactone that is not associated with this adverse effect.\textsuperscript{38} Amiloride also serves as an indirect aldosterone antagonist and it is another option.\textsuperscript{71} Patients with severe renal impairment should not use these drugs.\textsuperscript{38}

Other drugs for resistant hypertension include a beta blocker (eg, metoprolol), a vasodilating beta blocker (eg, carvedilol, labetalol, nebivolol [Bystolic]), a direct vasodilator (eg, hydralazine, minoxidil), or a centrally acting drug such as clonidine or guanfacine.\textsuperscript{9,38}

Another strategy that can be considered in patients with diabetes or CKD is adding a calcium channel blocker of the alternate class (eg, addition of a nondihydropyridine to a dihydropyridine), although evidence to support this is limited.\textsuperscript{72,73} When combined with a beta blocker, nondihydropyridine calcium channel blockers (ie, diltiazem, verapamil) can cause bradycardia, a risk that can be increased with additional use of clonidine.\textsuperscript{38}

Referral to a hypertension subspecialist should be considered when the BP level is not controlled adequately despite the use of four or five drugs.\textsuperscript{38}

*Case 3, cont’d.* Results of polysomnography for Bart confirm obstructive sleep apnea, and you prescribe use of continuous positive airway pressure. After several weeks of treatment, Bart reports having more energy and the in-office BP level is 136/85 mm Hg.
Hypertension is prevalent in older adults, and blood pressure (BP) level lowering has been shown to be one of the most important clinical interventions to reduce the risk of cardiovascular events. The goal BP level for older adults is individualized based on age, cardiovascular risk, overall health status (particularly frailty), and patient preferences. Recent guidelines differ but a goal systolic BP level lower than 150 mm Hg is reasonable for nearly all adults 60 years and older. In patients with isolated systolic hypertension, the degree to which systolic BP level lowering can be tolerated may be limited if the diastolic BP level decreases below 60 to 65 mm Hg. Orthostatic hypotension is common among older hypertensive patients. Symptoms of light-headedness should prompt an evaluation for orthostatic hypotension and a possible decrease in drug treatment. For relatively healthy older adults at increased cardiovascular risk, a systolic BP level goal lower than 140 mm Hg may be pursued. Although more aggressive BP level lowering is associated with a greater decrease in the number of cardiovascular events, it also is associated with a higher number of adverse events.

**Case 4. Mrs Campbell is a 77-year-old woman with osteoarthritis, osteoporosis, glaucoma, gastroesophageal reflux disease, and hypertension. Her drugs include tramadol 50 mg up to 2 times/day, alendronate 10 mg/day, omeprazole 20 mg/day, timolol 0.25% ophthalmic solution 1 drop/day in each eye, chlorthalidone 12.5 mg/day, and amlodipine 10 mg/day. The in-office blood pressure (BP) level is 155/62 mm Hg. She reports occasional afternoon light-headedness.**

The prevalence of consistently elevated blood pressure (BP) levels increases with age. Among individuals 75 years and older, approximately 3 out of 4 have hypertension (Table 8). Because overall cardiovascular risk also increases with age, the absolute risk reductions from BP level lowering in older patients are greater than those among young patients. However, treatment goals need to be balanced with comorbidities, overall health status, tolerability, possible adverse effects of drugs, and patient preferences.

**Isolated Systolic Hypertension and the J-Curve**

Because of reduced arterial compliance as individuals age, the systolic BP level rises while the diastolic BP level declines, so that older patients can exhibit isolated systolic hypertension. The risk of cardiovascular events (eg, myocardial infarction, left ventricular hypertrophy, stroke, cardiovascular-related death) correlates more closely with systolic than diastolic BP levels.

A meta-analysis published approximately 2 decades ago included eight trials of more than 15,000 patients age 60 years or older with isolated systolic hypertension. The number needed to treat (NNT) for 5 years to prevent 1 major cardiovascular event was 26. The

**Table 8**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age Group (Years)</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>55 to 64</td>
<td>54.6</td>
</tr>
<tr>
<td></td>
<td>65 to 74</td>
<td>62.0</td>
</tr>
<tr>
<td></td>
<td>≥75</td>
<td>76.4</td>
</tr>
<tr>
<td>Female</td>
<td>55 to 64</td>
<td>53.7</td>
</tr>
<tr>
<td></td>
<td>65 to 74</td>
<td>67.8</td>
</tr>
<tr>
<td></td>
<td>≥75</td>
<td>79.9</td>
</tr>
</tbody>
</table>

Note: These data were obtained using a definition of hypertension as a blood pressure level ≥140/90 mm Hg. The prevalence would be greater using the ≥130/80 mm Hg definition of hypertension as recommended in the 2017 American College of Cardiology/American Heart Association guideline.

NNT was 18 for men and 38 for women in this age group, with a lower NNT of 19 for patients age 70 years and older, and an NNT of 16 for patients with previous cardiovascular events.

Observational studies find that coronary heart disease risk varies directly with the systolic BP level and inversely with the diastolic BP level, which creates what is referred to as a J-curve for risk. Higher systolic and lower diastolic BP levels are both associated with increased risk. However, there are no trials that clearly provide data indicating the lowest diastolic BP level that elderly patients with isolated systolic hypertension can tolerate.

One study found that diastolic BP levels of 60 mm Hg or lower were associated with increased rates of cardiovascular and all-cause mortality. Other studies have shown an increased risk of stroke at diastolic BP levels lower than 65 mm Hg and an increased risk of myocardial infarction among patients with coronary heart disease with lower diastolic BP levels, particularly levels 60 mm Hg or lower.

Although it is not clear whether a lower diastolic BP level is causative, it seems prudent not to decrease the diastolic BP level below 65 mm Hg in patients with known coronary artery disease or below 60 mm Hg in general because hypoperfusion may result.

Case 4, cont’d. Because Mrs Campbell reports light-headedness, you ask the medical assistant to assess her orthostatic vital signs. The BP level while supine is 157/67 mm Hg and after she stands quietly for 3 minutes, the level is 152/60 mm Hg. Mrs Campbell notes a mild feeling of light-headedness on standing.

Management Goals
JNC 8 Panel Recommendations

At the time of the 2014 report of the Eighth Joint National Committee (JNC 8), high-quality evidence supported the initiation of drug treatment in the general population age 60 years or older to lower the BP level when it is 150/90 mm Hg or higher, treating to a BP level goal of less than 150/90 mm Hg.

Of all the recommendations in the guideline issued by the JNC 8 panel, this recommendation was the most controversial. A minority on the panel thought the evidence was insufficient to increase the systolic BP level goal from its previous level of less than 140 mm Hg. Members of this group were concerned that raising the goal could cause harm by increasing the risk of cardiovascular disease and partially reversing the progress made in reducing cardiovascular mortality rates among patients older than 60 years. They noted that use of a higher systolic BP level goal of less than 150 mm Hg only for frail patients age 80 years or older would address the concern that elderly patients are at higher risk of adverse events related to treatment.

ACP/AAFP Guideline and SPRINT Data

Based on a separate systematic review of the evidence, the American College of Physicians (ACP) and American Academy of Family Physicians (AAFP) also found that strong evidence supports the treatment of patients 60 years or older when the systolic BP level is 150 mm Hg or higher. Because it was published in 2017, the ACP/AAFP guideline included newer evidence from the Systolic Blood Pressure Intervention Trial (SPRINT).

Participants in SPRINT were 50 years or older with an increased risk of cardiovascular events. Overall, SPRINT showed a substantial benefit of use of a systolic BP level goal of 120 mm Hg rather than 140 mm Hg although significantly higher rates of some adverse events were found in the intensive treatment group.

Another analysis specifically focused on 2,510 SPRINT participants 75 years and older (mean age 79.9 years) with follow-up at approximately 3 years. Among this group there was a significantly lower rate of the primary composite cardiovascular disease outcome (102 events in the intensive treatment group versus 148 events in the standard treatment group [hazard ratio (HR) = 0.66; 95% CI = 0.51 to 0.85]) and a lower all-cause mortality rate (73 deaths versus 107 deaths, respectively [HR = 0.67; 95% CI = 0.49 to 0.91]) for participants who achieved the lower BP level goal with intensive treatment.

The overall rate of serious adverse events was 48% for both groups. However, more intensive antihypertensive therapy was associated with an increased risk of adverse events. Hypotension occurred in 2.4% of the intensive treatment group versus 1.4% of the standard treatment group (HR = 1.71; 95% CI = 0.97 to 3.09), syncope in 3.0% versus 2.4%, respectively (HR = 1.23; 95% CI = 0.76 to 2.00), electrolyte abnormalities in 4.0% versus 2.7% (HR = 1.51; 95% CI = 0.99 to 2.33), acute kidney injury in 5.5% versus 4.0% (HR = 1.41; 95% CI = 0.98 to 2.04), and injurious falls in 4.9% versus 5.5% (HR = 0.91; 95% CI = 0.65 to 1.29).

Of note, BP level measurement in SPRINT was performed using automated office measurement. This method minimizes the effects of white coat hyperten-
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sion and results in lower BP level measurements than those obtained by traditional office measurements.

The overall evidence suggests that adults 60 years or older with systolic BP levels of 140 mm Hg or higher may benefit from additional antihypertensive treatment, particularly adults with increased cardiovascular disease risk. Potential benefits are greater for those with higher BP levels.85

For older patients with systolic BP levels of 140 to 150 mm Hg, clinicians and patients should discuss risks and benefits of treatment. Such discussions should include the likelihood of cardiovascular events and the potential decrease in risk with treatment, possible adverse effects of more aggressive therapy, the need for follow-up and monitoring, and the choice of changing treatment if adverse effects occur. Select high-risk patients with systolic BP levels from 130 to 140 mm Hg also may benefit from treatment to achieve a lower BP level goal, taking into consideration the closer balance of the risks and benefits, in addition to comorbidities, overall health status, and patient preferences.85

Case 4, cont’d. You tell Mrs Campbell that you ideally want her systolic BP level to be lower than 150 mm Hg, but that her light-headedness and the low diastolic BP level of 60 mm Hg concern you. She agrees that she does not want to fall and possibly hurt her hip. You reduce the amlodipine dosage to 5 mg/day and plan to reassess the BP level and symptoms in 2 weeks.

Frailty and Elderly Patients

Management of hypertension in elderly patients can be complicated by comorbidities and frailty. For example, orthostatic hypotension is common among frail older patients, occurring in more than half of residents in long-term care facilities.86 Hypertensive older adults with orthostatic hypotension are significantly more likely to fall than patients without orthostatic hypotension.87 Consequently, antihypertensive treatment in elderly patients is associated with an increased risk of hip fracture during the first 45 days after initiation of therapy.88

Given the high prevalence and seriousness of orthostatic hypotension in elderly patients, physicians should measure supine and standing BP levels before initiation of antihypertensive drugs. Orthostatic hypotension is diagnosed when there is a 20 mm Hg or greater decrease in the systolic BP level or a 10 mm Hg or greater decrease in the diastolic BP level after 3 minutes of quiet standing.87

The Hypertension in the Very Elderly Trial (HYVET) offers some insight into the management of hypertension in elderly patients. In HYVET, 3,845 patients 80 years and older (mean age 83.6 years) with a sustained systolic BP level of 160 mm Hg or higher (mean 173/90.8 mm Hg) were assigned randomly to receive a sulfonamide diuretic or placebo. An angiotensin-converting enzyme inhibitor or placebo was added to the regimen for patients who did not meet the BP level goal of 150/80 mm Hg. If the treated BP level was 220/110 mm Hg or higher, or if additional antihypertensive drugs were needed to meet the target BP level, the patient was withdrawn from the double-blind follow-up. The primary end point was fatal or nonfatal stroke.89

At 2 years, the mean BP level was 15.0/6.1 mm Hg lower in the active therapy group compared with the placebo group. Among patients who received active treatment, there was a lower rate of death due to stroke (6.5% versus 10.7%) and a lower rate of all strokes (12.4% versus 17.7%; P <.06). The all-cause mortality rate also was lower in the active therapy group (47.2% versus 59.6% per 1,000 patient-years).89

A secondary analysis of HYVET participants who completed a frailty index showed no interaction between effects of hypertension treatment and frailty. Both the more frail and more fit older adults with hypertension were shown to benefit from treatment.90 Based on the HYVET results, older age alone is not a reason to withhold antihypertensive therapy.

In SPRINT, 27.6% of participants were classified as frail, a percentage comparable with that found in population studies.91 In an adjusted analyses of results, a 1% increase in the frailty index was shown to be significantly associated with a greater risk of self-reported falls (HR = 1.030), injurious falls (HR = 1.035), and all-cause hospitalizations (HR = 1.038).

Patients in long-term care facilities may represent a special population of frail older adults. In one study, 1,127 men and women older than 80 years (mean 87.6 years; 78.1% women) living in long-term care...
facilities underwent monitoring for 2 years. Patient BP levels were measured with assisted self-measurements for 3 consecutive days. This study found a significant relationship between a systolic BP level of less than 130 mm Hg and treatment with two or more antihypertensive drugs. Patients with these factors had higher mortality rates compared with other participants (adjusted HR = 1.78; 95% CI = 1.34 to 2.37).92

This significant risk persisted in the results of three sensitivity analyses. In propensity score-matched subsets, the adjusted HR was 2.05 (95% CI = 1.37 to 3.06). With adjustment for cardiovascular comorbidities, the HR was 1.73 (95% CI = 1.29 to 2.32), and with exclusion of patients without a history of hypertension who were taking drugs to lower BP levels, the adjusted HR was 1.76 (95% CI = 1.28 to 2.41).92

For older adults (ie, age 65 years or older) with hypertension and a high burden of comorbidities and limited life expectancy, it is reasonable to use clinical judgment, patient preferences, and a team-based approach to assess the risks and benefits when making decisions about the intensity of BP level lowering and the choice of antihypertensive drugs.9

Patients age 80 years and older who are found to be robust on frailty assessment could be treated to achieve a lower target systolic BP level. For frail elderly patients, the target systolic BP level should be adjusted upward from the recommended goal. Most frail patients should be treated with monotherapy, starting at a low dose and with titration of the drug dosage as tolerated. Pharmacotherapy should be reduced if such patients develop orthostatic hypotension.93

Case 4, cont’d. In 2 weeks, Mrs Campbell returns. The light-headedness has resolved with the decreased dose of amlo-dipine. The in-office BP level measures 158/68 mm Hg.
References


References


Suggested Reading


1. According to US Preventive Services Task Force recommendations, hypertension screening should be performed every 3 to 5 years for which one of the following patients with no additional risk factors?
   - A 30-year-old with a blood pressure (BP) level of 120/80 mm Hg and normal weight.
   - A 30-year-old with a BP level of 130/85 mm Hg and normal weight.
   - A 30-year-old with a BP level of 120/80 mm Hg and overweight.
   - A 40-year-old with a BP level of 120/80 mm Hg and normal weight.

2. Which one of the following statements about white coat hypertension is true?
   - It can be recognized using ambulatory blood pressure monitoring.
   - It increases the risk of cardiovascular events.
   - It should be managed with a thiazide diuretic or calcium channel blocker.
   - Management reduces the cost of care.

3. An increase in which one of the following factors has been shown to reduce blood pressure levels?
   - Alcohol intake.
   - Regular exercise.
   - Sodium intake.
   - Weight.

4. The guideline from which one of the following organizations redefines hypertension as a blood pressure level of 130 mm Hg systolic or higher or 80 mm Hg diastolic or higher?
   - American College of Cardiology/American Heart Association (2017).
   - Eighth Joint National Committee (2014).

5. Which one of the following drugs would be the best option for treatment of a woman with hypertension who becomes pregnant?
   - Aliskiren (a direct renin inhibitor).
   - Labetalol (an alpha and beta blocker).
   - Lisinopril (an angiotensin-converting enzyme inhibitor).
   - Valsartan (an angiotensin II receptor blocker).

6. Which one of the following includes the two most common types of organ damage in hypertensive emergency?
   - Acute pulmonary edema and cerebral infarction.
   - Acute pulmonary edema and renal failure.
   - Cerebral infarction and renal failure.

7. In which one of the following hypertensive emergencies is it appropriate to not lower the blood pressure level?
   - Acute congestive heart failure.
   - Acute ischemic stroke.
   - Acute kidney injury.
   - Acute myocardial infarction.

8. Which one of the following is an appropriate approach to lowering a blood pressure (BP) level of 200/105 mm Hg in a patient with evidence of acute aortic dissection?
   - Do not lower the BP level acutely.
   - Lower the BP level by a maximum of 25% during the first hour.
   - Lower the BP level to 160/100 mm Hg within 2 to 6 hours.
   - Lower the systolic BP level to 120 mm Hg or lower within 20 minutes.

9. Which one of the following statements is true of asymptomatic severe hypertension?
   - An electrocardiogram should be obtained.
   - It is uncommon.
   - Major adverse cardiovascular events occur in approximately 10% of patients.
   - It typically indicates poor control of chronic hypertension.

10. A hospitalized patient has a persistently elevated blood pressure level of 190/110 mm Hg but no symptoms or evidence of organ damage. Which one of the following management approaches is appropriate?
    - Administration of intravenous labetalol.
    - Administration of sublingual nifedipine.
    - Admission to the intensive care unit.
    - Prescription of a long-acting, oral antihypertensive drug.
11. An asymptomatic 55-year-old woman consistently takes three appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. The blood pressure level is 155/90 mm Hg. Which one of the following is the current diagnosis?
   q A. Controlled hypertension.
   q B. Hypertensive emergency.
   q C. Refractory hypertension.
   q D. Resistant hypertension.

12. Which one of the following factors makes it more difficult for patients to adhere to a prescribed antihypertensive regimen?
   q A. Fixed-dose combination pills.
   q B. Higher-cost treatment regimens.
   q C. Once-daily dosing.

13. Which one of the following secondary etiologies of resistant hypertension is rare?
   q A. Obstructive sleep apnea.
   q B. Pheochromocytoma.
   q C. Primary aldosteronism.
   q D. Renal artery stenosis.

14. Patients with resistant hypertension should avoid which one of the following?
   q A. Angiotensin-converting enzyme inhibitors.
   q B. Angiotensin II receptor blockers.
   q C. Low-sodium diet.
   q D. Nonsteroidal anti-inflammatory drugs.

15. Which one of the following antihypertensive drugs can cause gynecomastia in men when taken at high doses?
   q A. Chlorthalidone.
   q B. Eplerenone.
   q C. Hydrochlorothiazide.
   q D. Spironolactone.

16. Results of one study showed a significant increase in the rate of cardiovascular mortality among patients when diastolic blood pressure levels were lower than or equal to which one of the following?
   q A. 60 mm Hg.
   q B. 70 mm Hg.
   q C. 80 mm Hg.
   q D. 90 mm Hg.

17. An analysis of participants in the Systolic Blood Pressure Intervention Trial (SPRINT) who were 75 years and older found that intensive management of hypertension to a systolic blood pressure level goal of 120 mm Hg (rather than 140 mm Hg) decreased the rate of which one of the following?
   q A. Acute kidney injury.
   q B. All-cause mortality.
   q C. Electrolyte level abnormalities.
   q D. Injurious falls.

18. A 78-year-old patient undergoing treatment for hypertension is likely to benefit most from additional antihypertensive treatment in the presence of which of the following factors?
   q A. Systolic blood pressure (SBP) level of 140 mm Hg with no increased risk of cardiovascular disease (CVD).
   q B. SBP level of 145 mm Hg with no increased risk of CVD.
   q C. SBP level of 155 mm Hg with no increased risk of CVD.
   q D. SBP level of 155 mm Hg with increased risk of CVD.

19. Antihypertensive treatment in elderly patients is associated with an increased risk of hip fracture during the first 45 days after initiation of therapy.
   q A. True.
   q B. False.

20. For orthostatic hypotension to be diagnosed, how much does the blood pressure (BP) level need to decrease after 3 minutes of quiet standing?
   q A. 5 mm Hg or greater in diastolic BP.
   q B. 10 mm Hg or greater in diastolic BP.
   q C. 10 mm Hg or greater in systolic BP.
   q D. 15 mm Hg or greater in systolic BP.
Posttest Answers

Question 1: The correct answer is A.
The US Preventive Services Task Force recommends annual hypertension screening for adults 40 years and older and for patients at increased risk of hypertension, which includes patients with blood pressure levels of 130 to 139/85 to 89 mm Hg, who are overweight or obese, or who are African American. Adults ages 18 to 39 years with blood pressure levels lower than 130/85 mm Hg who do not have additional risk factors should be screened every 3 to 5 years. See page 11.

Question 2: The correct answer is A.
Use of ambulatory blood pressure monitoring permits recognition of white coat hypertension (ie, elevated blood pressure level that occurs only in clinical settings), for which the evidence shows that management is not needed. See page 12.

Question 3: The correct answer is B.
Several lifestyle modifications have been shown to reduce blood pressure levels and are recommended as part of the management of patients with hypertension. These recommendations include weight loss for overweight or obese patients, regular exercise, the Dietary Approaches to Stop Hypertension (DASH) diet, reduced dietary sodium intake, and reduced alcohol intake. See pages 12-13.

Question 4: The correct answer is B.
In November 2017, the American College of Cardiology/American Heart Association, along with nine other health professional organizations, released a guideline for the prevention, detection, evaluation, and management of high blood pressure (BP) in adults. The major change in this guideline is the redefinition of hypertension as a BP level of 130 mm Hg systolic or higher or 80 mm Hg diastolic or higher. See page 14.

Question 5: The correct answer is B.
Women with hypertension who become pregnant should be transitioned to methyldopa, nifedipine, and/or labetalol during pregnancy. See Table 2.

Question 6: The correct answer is A.
The two most common types of organ damage in hypertensive emergency are cerebral infarction and acute pulmonary edema. See page 16.

Question 7: The correct answer is B.
In a patient with acute ischemic stroke, the blood pressure (BP) level typically should not be lowered. A neurology subspecialist should be consulted immediately to determine whether the patient is a candidate for thrombolytic therapy, which first may require gradual BP level lowering. See page 17.

Question 8: The correct answer is D.
In a patient with acute aortic dissection, the systolic blood pressure level should be decreased to 120 mm Hg or lower within 20 minutes. See page 17.

Question 9: The correct answer is D.
Asymptomatic severe hypertension typically represents poor control of chronic hypertension. See page 17.

Question 10: The correct answer is D.
Patients with persistently elevated blood pressure levels in the hospital setting should be treated as having uncontrolled hypertension, with initiation of an antihypertensive drug, titration of the current drug dosage, or the addition of a long-acting, oral antihypertensive drug and follow-up with the family physician after hospital discharge. See page 19.

Question 11: The correct answer is D.
Resistant hypertension is defined as a blood pressure level above the goal level despite use of a combination of three or more appropriately dosed antihypertensive drugs of different classes, one of which is a diuretic. See page 20.

Question 12: The correct answer is B.
Patients may have difficulty affording their drug prescriptions, so prescribing of low-cost regimens can be important. See page 21.

Question 13: The correct answer is B.
Secondary etiologies are more common in patients with resistant hypertension. Even among patients with resistant hypertension, some etiologies such as hyperadrenocorticism (Cushing syndrome) and pheochromocytoma are rare. See page 22 and Table 6.

Question 14: The correct answer is D.
Nonsteroidal anti-inflammatory drugs (NSAIDs) enhance sodium retention and can decrease the effectiveness of most antihypertensive drugs. Patients with resistant hypertension should be advised to avoid or strictly limit use of NSAIDs. See page 24.

Question 15: The correct answer is D.
High doses of spironolactone can cause gynecomastia in men. See page 25.
Question 16: The correct answer is A.
One study found that diastolic blood pressure levels of 60 mm Hg or lower were associated with increased rates of cardiovascular and all-cause mortality. See page 27.

Question 17: The correct answer is B.
An analysis specifically focused on 2,510 Systolic Blood Pressure Intervention Trial (SPRINT) participants 75 years and older (mean age 79.9 years) with follow-up at approximately 3 years. Among this group there was a significantly lower rate of the primary composite cardiovascular disease outcome (102 events in the intensive treatment group versus 148 events in the standard treatment group [hazard ratio (HR) = 0.66; 95% CI = 0.51 to 0.85]) and a lower all-cause mortality rate (73 deaths versus 107 deaths, respectively [HR = 0.67; 95% CI = 0.49 to 0.91]) for participants who achieved the lower blood pressure level goal (120 mm Hg rather than 140 mm Hg) with intensive treatment. See page 27.

Question 18: The correct answer is D.
The overall evidence suggests that adults 60 years or older with systolic blood pressure levels of 140 mm Hg or higher may benefit from additional antihypertensive treatment, particularly adults with increased cardiovascular disease risk. See page 28.

Question 19: The correct answer is A.
Antihypertensive treatment in elderly patients is associated with an increased risk of hip fracture during the first 45 days after initiation of therapy. See page 28.

Question 20: The correct answer is B.
Orthostatic hypotension is diagnosed when there is a 20 mm Hg or greater decrease in the systolic blood pressure (BP) level or a 10 mm Hg or greater decrease in the diastolic BP level after 3 minutes of quiet standing. See page 28.
Notes
The next edition of AAFP FP Essentials™ will be:

Musculoskeletal Therapies