An Evidence-Based Approach To Managing Asymptomatic Elevated Blood Pressure In The Emergency Department

Abstract

Hypertension is a common chronic illness that affects 50 million individuals in the United States and approximately 30% of adults worldwide. United States emergency departments report > 900,000 annual visits for hypertension-related complaints and studies show that approximately one-third of patients with elevated blood pressure lack a formal prior diagnosis. These patients are at risk for long-term morbidity and mortality from cardiovascular, ocular, and neurological consequences. This review examines the most current evidence regarding emergency department treatment of asymptomatic hypertension, including differentiating hypertensive emergency from poorly controlled hypertension, recommendations for choosing appropriate treatment, determining the need for admission, and guidelines for disposition and follow-up.

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CME Objectives
Upon completion of this article, you should be able to:
1. Describe the difference between hypertensive emergency and urgency.
2. Identify common causes for the presentation of elevated blood pressure in patients with and without a prior diagnosis of hypertension.
3. Follow the recommended treatment algorithm for patients with elevated blood pressure.
4. Effectively counsel patients on blood pressure control and further steps in management.

Prior to beginning this activity, see “Physician CME Information” on the back page.

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Case Presentations

You start your shift on Monday morning with a 52-year-old woman referred by her primary care physician’s office for a blood pressure of 190/120 mm Hg. She had been previously diagnosed with hypertension and presented for her regular physical that day. When you see her, she has a blood pressure of 160/100 mm Hg and denies headache, chest pain, shortness of breath, or any vision changes. Her physical exam is normal. She confesses that she has been poorly compliant with her hydrochlorothiazide. You wonder why she was sent to the ED, but now that she is here, what should you do?

Several patients later, you see a 35-year-old uninsured man presenting for an ankle sprain. His blood pressure is persistently elevated at 220/110 mm Hg during his stay. He carries no prior diagnosis of hypertension and only complains of severe pain in his ankle. Despite treatment with oxycodone and alleviation of his pain, he remains significantly hypertensive. You wonder if you should treat the blood pressure…

Your next patient is a 78-year-old woman who is brought in by her family for a concern of new-onset hypertension. She has no recent medical history and is on no medications. She had her blood pressure checked several times over the preceding weeks at a pharmacy, and it was consistently around 150/90 mm Hg. Her exam is normal. She does not have a family physician and the earliest appointment the family has been able to get with an internist is in 3 weeks. The family is appropriately worried and asks you if you could start her on medication, but you aren’t sure if this is the best way to manage this patient.

Introduction

Emergency clinicians treat hypertension in a variety of contexts: the compliant patient on antihypertensive medications who notes an abnormal blood pressure, the asymptomatic patient with severely elevated blood pressure who carries no prior diagnosis, and the patient presenting in extremis with severe shortness of breath, chest pain, and markedly elevated blood pressure. The focus of this systematic review of the literature is the emergency department (ED) management of asymptomatic hypertension as opposed to hypertensive crisis or hypertensive emergency. Hypertensive emergency or crisis is defined as an acute elevation of blood pressure, typically ≥ 180/120 mm Hg, with end-organ damage involving the brain, heart, kidneys, vasculature, or retina. While a hypertensive emergency can occur de novo, it usually presents in patients with prior chronic hypertension. Hypertensive urgency is defined as severe hypertension without acute end-organ damage. Some groups advocate distinguishing hypertensive urgency from uncomplicated, severely elevated blood pressure, where patients with urgency have evidence of chronic target-organ damage (see Table 1).

While there are many guidelines and individual articles on management of asymptomatic elevated blood pressure, there is much provider variability in treatment, largely due to the spectrum of the disease. This review outlines new findings in the field of hypertension, particularly as they pertain to the practice of emergency medicine, and suggests a management algorithm based on the best available evidence.

Defining Hypertension

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) defines normal blood pressure for adults ≥ 18 years of age as a systolic blood pressure of < 120 mm Hg and a diastolic blood pressure of < 80 mm Hg. Above this cut-off, blood pressure ranges are defined for prehypertension, stage 1 hypertension, and stage 2 hypertension. (See Table 2, page 3.) The guidelines suggest that the diagnosis of hypertension is based on the mean of 2 or more properly measured blood pressure readings on each of 2 or more office visits. However, more recently, ambulatory blood pressure and home blood pressure measurements have become acceptable alternatives for diagnosing hypertension. In clinical studies, the term markedly elevated blood pressure is synonymous with the JNC 7 definition of stage 2 hypertension. The stratification of patients into different blood pressure categories helps guide treatment.

The 2013 European Society of Hypertension and European Society of Cardiology (ESH/ESC) guidelines for the management of arterial hypertension have similar definitions for hypertension, but they divide blood pressures < 140/90 mm Hg into 3 categories (optimal, normal, and high-normal) instead.

| Brain | • Acute ischemic stroke  
| Hypertensive encephalopathy  
| Intracerebral or subarachnoid hemorrhage |
| Heart | • Acute heart failure  
| • Acute coronary syndromes |
| Vascular | • Aortic dissection |
| Kidney | • Acute renal insufficiency  
| • Acute glomerulonephritis |
| Other | • Eclampsia  
| • Retinal hemorrhage or papilledema  
| • Microangiopathic hemolytic anemia |

of using the terms normal or prehypertensive. 6

See Table 3 for critical considerations in the ED treatment of hypertension.

Critical Appraisal Of The Literature

A search using Ovid Medline6 (www.ovid.com) was launched for articles published from January 1990 to December 2014. Keywords included hypertension, emergency department, emergency medical services, elevated blood pressure, and hypertensive urgency; 5878 articles were screened for inclusion and 187 articles were determined to be relevant for review.

The Cochrane Database of Systematic Reviews was also searched and yielded 134 articles, 4 of which were deemed to be appropriate for this review.

A search of the National Guidelines Clearinghouse (www.guideline.gov) produced 113 guidelines. Three guidelines were found to be relevant to the management of elevated blood pressure in ED patients. Additional references were selected from works cited in the reviewed articles.

Available Guidelines For Hypertension Management

The 2013 American College of Emergency Physicians (ACEP) clinical policy on asymptomatic hypertension highlights the paucity of research in the ED management of patients with elevated blood pressure who are not exhibiting symptoms of target-organ damage. 7 It addresses 2 major questions. The first question is whether screening for target-organ injury reduces rates of adverse outcomes in ED patients with asymptomatic elevated blood pressure. The ACEP Committee concluded that routine screening of ED patients is not required, but in patients with poor follow-up, screening for elevated creatinine may identify acute kidney injury that necessitates hospital admission or very close follow-up. This suggests that the disposition may change when laboratory studies are conducted.

Table 2. Definitions Of Hypertension1,3

<table>
<thead>
<tr>
<th>Normal blood pressure</th>
<th>Blood pressure &lt; 120/80 mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehypertension</td>
<td>Blood pressure 120-139 mm Hg systolic or 80-89 mm Hg diastolic</td>
</tr>
<tr>
<td>Stage 1 hypertension</td>
<td>Blood pressure 140-159 mm Hg systolic or 90-99 mm Hg diastolic</td>
</tr>
<tr>
<td>Stage 2 hypertension</td>
<td>Blood pressure 160-179 mm Hg systolic or 100-109 mm Hg diastolic</td>
</tr>
<tr>
<td>Hypertensive urgency</td>
<td>Blood pressure ≥ 180/110 mm Hg without acute end-organ dysfunction</td>
</tr>
<tr>
<td>Hypertensive emergency</td>
<td>Blood pressure ≥ 180/110 mm Hg with acute end-organ dysfunction</td>
</tr>
</tbody>
</table>

The second question addressed is whether ED medical intervention reduces rates of adverse outcomes in patients with asymptomatic markedly elevated blood pressure. The recommendation states that medical intervention is not required, but patients with poor follow-up can be treated with blood pressure-lowering medication in the ED or they may be discharged with a prescription for such therapy. Both recommendations are based on Class III studies or expert consensus due to the lack of high-quality clinical studies addressing these issues. Currently, there are clinical trials underway that may support the provision of antihypertensive medications to a broader population. A discussion of first-line medication that may be potentially provided on discharge follows in the Treatment section (page 10).

The JNC 7 recommends that patients with markedly elevated blood pressure and end-organ damage be admitted to the hospital. 1 Patients with markedly elevated blood pressure without target-organ damage do not necessarily require admission, but they should be treated with oral antihypertensive therapy. Patients with severely elevated asymptomatic hypertension should not leave the ED without a confirmed follow-up visit within a few days. This recommendation is based on expert consensus and is targeted at primary care providers. While there is no specific recommendation for care of these patients in the ED setting, it can be extrapolated that emergency clinicians should admit patients with markedly elevated blood pressure and acute end-organ damage to a monitored setting. All other patients should be counseled and referred. Some patients may benefit from a prescription for a long-term antihypertensive medication. When discharge is planned, there is no role for acute lowering of blood pressure with parenteral or oral therapy in patients without acute end-organ damage. 1

The 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults: Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8) only addresses treatment thresholds for chronic hypertension and there is no mention of acute emergency care. 5 In ad-
dation, the JNC 8 remains controversial, and many of its recommendations are not supported by other societies involved in the management of hypertension. The American Heart Association (AHA), the American College of Cardiology (ACC), and the National Heart, Lung, and Blood Institute (NHLBI) do not endorse JNC 8 recommendations. The point of greatest contention is the increase in the systolic pressure treatment threshold in patients aged ≥ 60 years. Many experts contend that the blood pressure target of < 150/90 mm Hg (rather than < 140/90 mm Hg) will lead to undertreatment and an increase in cardiovascular events. Specifically, in a cohort of patients recruited from cardiology clinics and considered to be at high risk, the higher treatment threshold advocated by the JNC 8 could potentially cause an additional 8000 cardiovascular events over 10 years in the 80,000 patients aged ≥ 60 years captured by the registry.9

A 2014 science advisory by the AHA, ACA, and Centers for Disease Control and Prevention (CDC)10 calls for system-wide change to achieve more population-level blood pressure control. The AHA has made hypertension a primary focus area of its strategic plan and has set a goal to improve the cardiovascular health of all Americans by 20% and reduce mortality from cardiovascular disease and stroke by 20% in 2020. The identification of best-practice, evidence-based management algorithms to standardize treatment is a critical element in achieving these national goals. They argue that, despite the existence of therapies to lower blood pressure and the known associated risks of cardiovascular and other events, more than 50% of patients with known hypertension have poor control. Additionally, the direct and indirect costs, by 2008 estimates of hypertension, are $69.9 billion, and hypertension was implicated as the primary or contributing cause of death in 15% of all deaths in 2009. Their suggested treatment algorithm is discussed in the Treatment section (page 10).

Etiology And Pathophysiology

Epidemiology
Hypertension is a chronic illness that affects 50 million individuals in the United States and approximately 30% of adults worldwide.1 In 2009, United States EDs reported > 900,000 visits for hypertension-related complaints. This number of visits is an increase of approximately 20% since 2006.11 Prevalence estimates of uncontrolled blood pressure in ED patients range from 3% to 45%.12-17 This indicates that the true prevalence is not yet well established and requires further research. Studies report that approximately one-third of patients seen in the ED with elevated blood pressure lack a prior formal diagnosis.15

In a national sample, an estimated 35.8 million patients (50% of all United States patients with hypertension) had uncontrolled hypertension. Of these, 90% had insurance and a usual source of healthcare (defined as a single place where they sought care, as opposed to multiple sites). It is estimated that 3 out of 4 people with uncontrolled hypertension (approximately 26 million people) visited a healthcare professional at least twice in the prior year.18 This suggests that there are missed opportunities in providing optimal treatment.

Most concerning, the JNC 7 notes that 30% of adult patients are unaware of their hypertension and up to 40% of people with hypertension are not receiving treatment. There is certainly opportunity in the ED setting to improve awareness of the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease, and peripheral vascular disease.

Risk Factors
Advancing age, black race, and family history are irreversible risk factors for hypertension. Additional risk factors that may be reversible include obesity, lack of exercise, excessive alcohol intake, and diets high in sodium and low in potassium.2,19

Etiology
It is helpful to distinguish between primary (formerly known as essential) and secondary hypertension. Primary hypertension is hypertension without a specific secondary cause; it may develop as a result of genetic or environmental factors. Secondary hypertension is related to an underlying pathologic process, typically including renal, vascular, or endocrine causes.

In all age groups, primary hypertension is significantly more common than secondary hypertension. Secondary hypertension makes up only 5% to 10% of patients diagnosed with hypertension. Causes of secondary hypertension include primary aldosteronism, Cushing syndrome, pheochromocytoma, and renovascular hypertension. Iatrogenic causes of secondary hypertension that should be considered in the patient’s workup include the chronic use of oral contraceptives, nonsteroidal anti-inflammatory drugs (NSAIDs),20 and antidepressants. While NSAIDs have been implicated in elevated blood pressure, in a large prospective cohort study in the United Kingdom, acetaminophen did not result in a sustained rise in blood pressure.21 Alcohol consumption exceeding 3 drinks per day is also implicated in elevated blood pressure. There are several hypotheses on this mechanism, including an activation of the renin-angiotensin-aldosterone axis, an increase in adrenergic nervous system discharge, and a decrease in nitric oxide release.22 In children, consideration should be given to coarctation of the aorta as a cause for secondary hypertension; it typically presents
pertension. In addition, increased sympathetic tone is likely a cause, which could be due to a genetic predisposition toward increased sympathetic nervous system activity compounded by other stressors such as obesity or high dietary sodium intake. Additionally, increased angiotensin II activity, mineralocorticoid excess, and reduced nephron mass may predispose an individual to primary hypertension. This should not be confused with renovascular hypertension, which is a narrowing of 1 or both of the arteries supplying the kidney, and is a type of secondary hypertension.

**Effects Of Long-Term Hypertension**

In a patient with hypertension, cardiac remodeling occurs over time, secondary to increased peripheral vascular resistance. Increased cardiac output may be seen early, but is not a consistent finding. Recall the equation:

\[
\text{Blood pressure} = \text{Peripheral vascular resistance} \times \text{cardiac output}
\]

### Table 4. Secondary Hypertension: Causes And Making A Diagnosis

<table>
<thead>
<tr>
<th>Causes</th>
<th>Signs/Symptoms</th>
<th>Diagnostic Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarctation of the aorta</td>
<td>• Delayed or absent femoral pulses&lt;br&gt;• Murmur&lt;br&gt;• Arm-to-leg systolic blood pressure difference &gt; 20 mm Hg</td>
<td>• MRI&lt;br&gt;• Transthoracic echocardiography</td>
</tr>
<tr>
<td>Renal artery stenosis</td>
<td>• Renal bruist&lt;br&gt;• Increased serum creatinine after initiation of ACEI or ARB&lt;br&gt;• Serum chemistry with elevated creatinine&lt;br&gt;• Proteinuria on urinalysis</td>
<td>• CT&lt;br&gt;• Duplex ultrasonography of renal arteries&lt;br&gt;• MRI</td>
</tr>
<tr>
<td>Thyroid disorders</td>
<td>• Bradycardia or tachycardia&lt;br&gt;• Weight gain or loss&lt;br&gt;• Abnormal menstrual cycle</td>
<td>• TSH laboratory testing</td>
</tr>
<tr>
<td>Aldosteronism</td>
<td>• Limb weakness&lt;br&gt;• Hypokalemia on serum chemistry, renin ratio</td>
<td>• Plasma aldosterone-renin ratio</td>
</tr>
<tr>
<td>Obstructive sleep apnea</td>
<td>• Snoring&lt;br&gt;• Daytime sleepiness&lt;br&gt;• Apneic events</td>
<td>• Sleep study</td>
</tr>
<tr>
<td>Pheochromocytoma</td>
<td>• Flushing&lt;br&gt;• Headaches&lt;br&gt;• Syncope&lt;br&gt;• Tachycardia&lt;br&gt;• Paroxysmal blood pressures</td>
<td>• Plasma or urine metanephrines or catecholamines</td>
</tr>
<tr>
<td>Cushing syndrome</td>
<td>• Buffalo hump&lt;br&gt;• Central obesity&lt;br&gt;• Moon facies&lt;br&gt;• Striae&lt;br&gt;• Hyperglycemia</td>
<td>• 24-hour urinary cortisol&lt;br&gt;• Dexamethasone suppression testing</td>
</tr>
<tr>
<td>Primary hyperparathyroidism</td>
<td>• Hypercalcemia&lt;br&gt;• Elevated parathyroid hormone</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; CT, computed tomography; MRI, magnetic resonance imaging; TSH, thyroid-stimulating hormone.

In a study by Levy et al in a cohort comprised mostly of black patients in an urban ED, 90% of patients with asymptomatic hypertension had subclinical heart disease on echocardiography. This suggests that cardiac remodeling has already occurred in patients who present without symptoms or signs of target-organ damage.

Hypertension is a risk factor for left ventricular hypertrophy, angina, myocardial infarct, stroke, kidney failure, peripheral arterial disease, retinopathy, and dementia. While these risks are frequently considered to be associated with long-standing elevated hypertension in patients with poor control, a recent meta-analysis suggests that even patients with blood pressure in the prehypertensive range are at significant risk. In a study by Vasan et al, blood pressure in the prehypertensive range was associated with a risk-adjusted hazard ratio of 2.5 in women and 1.6 in men, compared with optimal blood pressure. Powers et al found a lower stroke risk in patients with risk factors for stroke when blood pressure was treated more aggressively to <130/85 mm Hg. A meta-analysis by Huang et al also found that blood pressure in the prehypertension range increased the risk of stroke. This indicates that, over time, even minimal persistent elevations of blood pressure can have adverse effects; however, aggressive drug management in patients with prehypertension remains controversial.

**Differential Diagnosis**

In approaching a patient with elevated blood pressure, it is helpful to initially consider the most dangerous causes. (See Table 5.) Stroke, aortic dissection, pre-eclampsia, drug intoxication or withdrawal, renal failure, pheochromocytoma, or thyroid storm should be included in the differential diagnosis. Once these are excluded by history, physical examination, or diagnostic testing, consideration can be given to more benign causes of hypertension such as primary hypertension (often newly diagnosed), hyperthyroidism, obstructive sleep apnea, Cushing syndrome, hyperaldosteronism, and renovascular hypertension.

An important etiology of elevated blood pressure in the ED setting is drug withdrawal syndrome. Hypertension and elevated pulse rate are frequently seen in withdrawal from alcohol, benzodiazepines, and opioids. Often, the patient will report a history of long-term drug or alcohol use and will exhibit other features suggestive of withdrawal. In alcohol withdrawal, signs and symptoms may include agitation, tremors, disorientation, and mydriasis. Withdrawal from benzodiazepines or other sedatives may present with agitation, tremulousness, diaphoresis, and convulsions. Opioid withdrawal classically presents with mydriasis, vomiting, diarrhea, diaphoresis, and piloerection.

Considering the differential diagnosis and distinguishing between the possible etiologies is advisable, as it will help guide testing, treatment, and further follow-up.

**Prehospital Care**

Prehospital personnel can contribute to distinguishing between various etiologies of hypertension. Often, drug paraphernalia or medication can be found at the patient’s home. A patient who is referred to the ED by a primary care provider may have paperwork detailing the prior workup for hypertension or the reason for referral. Elevated blood pressure alone does not often necessitate an ambulance transfer to the hospital, but the patient’s symptoms may explain why they were referred. Ideally, the patient’s hypertension history should be obtained, including the medications the patient is currently taking and the last dose administered. If the patient is not transported to the hospital, she should be advised of her blood pressure reading and told to follow up with her primary care provider.

The reliability of blood pressures taken by emergency medical services (EMS) personnel has been the subject of much debate. A prospective trial compared expert blood pressure measurements to EMS provider–taken blood pressures and found no significant difference. However, the experts were trained resident advisors, rather than nurses or physicians. Regardless, blood pressure should be remeasured at triage.

The reduction of elevated blood pressure in the field with antihypertensives is not advised. Most advanced life support services do not carry appropriate medication to address hypertensive emergency, and it is often difficult to discern what the cause of the patient’s elevated blood pressure is in the prehospital setting. While the use of antihypertensive medications in the prehospital setting is not advised, the treatment of pain in suspected coronary events

**Table 5. Differential Diagnosis Of Hypertension In The Emergency Department**

<table>
<thead>
<tr>
<th>Acutely Dangerous</th>
<th>Less Acutely Dangerous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>Obstructive uropathy</td>
</tr>
<tr>
<td>Aortic dissection</td>
<td>Hyperthyroidism/hyperparathyroidism</td>
</tr>
<tr>
<td>Drug intoxication: cocaine, amphetamine, monoamine oxidase inhibitor</td>
<td>Sleep apnea</td>
</tr>
<tr>
<td>Drug withdrawal: antihypertensive, alcohol, sedative-hypnotics</td>
<td>Cushing syndrome</td>
</tr>
<tr>
<td>Renal failure</td>
<td>Primary hyperaldosteronism</td>
</tr>
<tr>
<td>Pheochromocytoma or other tumor</td>
<td>Renovascular hypertension</td>
</tr>
<tr>
<td>Thyroid storm</td>
<td>Essential hypertension</td>
</tr>
</tbody>
</table>
with opioids and the treatment of acute pulmonary edema with nitroglycerin are common practices and should be encouraged.

**Emergency Department Evaluation**

The evaluation of elevated blood pressure involves measuring the patient’s vital signs, completing a targeted medical history and physical examination, and obtaining laboratory studies or an electrocardiogram (ECG), where indicated. The emergency clinician should search for possible causes of the elevated blood pressure and the presence of end-organ disease and should make decisions as to necessary therapy based on etiology and risk.

A complete set of vital signs is typically performed upon patient arrival to the ED. The triage of patients with elevated blood pressure is dependent on the triage personnel’s concern for serious disease. Currently, blood pressure is not a criterion specifically used to assign an Emergency Severity Index (ESI) level at triage.30

Miltner et al examined the consistency of vital sign checks during ED visits across the Veterans Health Administration facilities. Most facilities documented a blood pressure for > 75% of patient visits. However, 8 facilities (9.1%) had blood pressure documented in < 50% of visits. The mean number of times that blood pressure was recorded per visit in all patients was 1.23 (standard deviation, 1.175). The median time between blood pressure measurements was 139.7 minutes (interquartile range, 81.6-230.1).31 This indicates that routine checking of blood pressure in patients presenting to the ED may not be standard. It is unclear whether the typical community or academic ED has comparable rates of blood pressure checks, given the lack of literature in this area. It is advisable to check blood pressure for all patients during their ED visit. Patients with elevated blood pressure may be asymptomatic but require follow-up. A significantly elevated or decreased blood pressure may also give emergency clinicians clues to the diagnosis and necessitate acute intervention.

**Measuring Blood Pressure**

The following evidence-based recommendations are made to measure blood pressure accurately (1 consensus-based recommendation is marked with an asterisk).2,32

- Patients should avoid caffeine or nicotine use 30 minutes prior to taking blood pressure.
- Patients should stay seated for at least 5 minutes with their back supported.
- The length of the bladder cuff should be 80% of the circumference of the upper arm, and the width should be at least 40%.
- Patients should refrain from talking.
- No tight clothing should constrict the upper arm, and close-fitting items should be removed prior to taking blood pressure.

Compliance with these guidelines is not always possible in the ED setting, as patients do not routinely abstain from coffee and cigarettes prior to triage and many patients may not be able to sit up, due to C-spine immobilization after trauma or a variety of other conditions. However, when an abnormal blood pressure measurement is obtained, it is reasonable to check the cuff size, as a cuff that is too small may result in a falsely elevated blood pressure.33 Emergency clinicians should also check the position of the patient and advise the patient to abstain from talking or moving during measurement.

In a randomized controlled trial conducted in the primary care setting, where blood pressure measured by an ambulatory blood pressure monitor was considered the gold standard, an automated blood pressure measurement was found to be more accurate than a manual blood pressure assessment.34

**History**

Table 6 (page 8) summarizes the questions that patients with elevated blood pressure should be asked during history taking.

**Physical Examination**

A complete set of vital signs should be part of the physical examination of each patient. When blood pressures fall outside of the range expected for the patient’s history and current condition, it is advisable to repeat the blood pressure measurement, observing appropriate technique as outlined previously. In the outpatient setting, use of automated sphygmomanometers without the supervision of providers has been shown to reduce measurement error and minimize anxiety-related increases in the blood pressure, as compared with manual office blood pressure measurements.35,36 In the majority of United States EDs, initial blood pressure measurements are taken in the triage area in the presence of at least 1 provider. One may obtain a more accurate measure by allowing for automatic cycling of blood pressures or a patient-initiated blood pressure measurement without provider presence; however, there is no evidence that this is applicable to the ED setting.

In addition to obtaining vital signs, a targeted physical examination should be performed. A murmur of aortic regurgitation, asymmetrical pulses, and neurologic deficits on examination can point to aortic dissection. Looking for jugular venous distension, auscultating the lungs, and evaluating for pedal edema may assist in making a diagnosis of...
Laboratory Studies
The following workup should be considered:
- Serum creatinine, potassium, and calcium, and a urinalysis may help screen for secondary hypertension.
- A chest x-ray, ECG, urinalysis, serum creatinine or serum urea nitrogen, uric acid, and urine microalbumin levels can help identify target-organ injury.
- The JNC 7 recommends routine laboratory testing, including a chemistry, an ECG, a chest x-ray, and a urinalysis, prior to initiating therapy. (The JNC 8 does not comment on recommended laboratory tests.)

The ACEP clinical policy on asymptomatic hypertension states that laboratory testing for asymptomatic patients with elevated blood pressure should not be conducted routinely but may be helpful in select patients. These select patients include those with poor follow-up and patients in whom a blood chemistry may expose evidence of acute kidney injury and affect disposition. This recommendation is based primarily on Class III studies and is, therefore, a Level C recommendation, according to their classification system. They note that, while in this latter population there was a disposition change to admission, only patients with markedly elevated blood pressure were enrolled. Given that there was no normotensive control group, the baseline rate of renal dysfunction due to all causes in the ED populations in these studies was unclear.

**Table 6. Key Questions Regarding History Of The Present Illness**

<table>
<thead>
<tr>
<th>Question</th>
<th>Comments/Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you ever been told you have high blood pressure?</td>
<td>Open-ended, inclusive question; many people do not think they have high blood pressure if they are taking—or have in the past taken—medication for it</td>
</tr>
<tr>
<td>Do you have any chest pain?</td>
<td>Myocardial infarction, aortic dissection</td>
</tr>
<tr>
<td>Do you have any shortness of breath?</td>
<td>Myocardial infarction, aortic dissection, pulmonary edema, heart failure</td>
</tr>
<tr>
<td>Are you on any medications, or are you using any recreational drugs or herbal medicines?</td>
<td>Neuroleptic malignant syndrome; serotonin syndrome; cocaine, phenylcyclidine, or other sympathomimetics</td>
</tr>
<tr>
<td>Have you recently stopped taking any medications or recreational drugs or herbal medicines?</td>
<td>Delirium tremens, clonidine, and other drug withdrawal</td>
</tr>
<tr>
<td>Have you had any focal weakness, slurring of speech, numbness, or clumsiness?</td>
<td>Stroke, transient ischemic attack, intracranial hemorrhage</td>
</tr>
<tr>
<td>Do you snore or wake up during sleep? Do you feel tired throughout the day?</td>
<td>Obstructive sleep apnea</td>
</tr>
<tr>
<td>Have you had high blood pressure in the past that has not responded to multiple medications?</td>
<td>Renovascular hypertension, hyperaldosteronism, pheochromocytoma</td>
</tr>
<tr>
<td>Have your blood pressure medications changed recently or has the dose decreased?</td>
<td>This may elucidate whether the patient has had periods of orthostatic hypotension, dizziness, or other medication side effects that have caused an adjustment of medication and may explain why the blood pressure is now elevated</td>
</tr>
<tr>
<td>How are you taking your current blood pressure medication?</td>
<td>Patients may be taking their blood pressure medication as needed rather than as scheduled. If the patient does not know his regimen, ask who administers the medication. This may point to memory impairment or other barriers in correct administration, which can be corrected</td>
</tr>
</tbody>
</table>
In a cohort of ED patients who either had diastolic blood pressure ≥ 115 mm Hg that persisted for at least 30 minutes or required treatment, 100% of patients with an elevated creatinine would have been detected using proteinuria or hematuria. The specificity of urine dipstick for elevated creatinine in this population was only 29.7%, but urine dipstick may have potential value as a screening test for patients with hypertension and renal failure.40 See Table 7 for a list of laboratory tests and their usefulness in the ED setting.

Chest Radiographs
A chest radiograph may be helpful in determining pulmonary edema and cardiomegaly. A widened mediastinum can be seen in 80% of patients with aortic dissection and may be used as a screening test in the patient with chest pain. However, the utility of routine chest x-ray in patients with asymptomatic hypertension is questionable.

Electrocardiogram
ECG is often performed as part of the ED evaluation of chest pain and dyspnea, although the need for it is unclear in patients with elevated blood pressure without symptoms. In response to hypertension, the heart undergoes remodeling over time. The increased wall stress leads to dysfunction, dilation, and additional wall stress, leading to hypertrophy. The ECG in long-standing hypertension may show left ventricular hypertrophy. (See Figure 1.) A definitive diagnosis of left ventricular hypertrophy must be made by advanced imaging, which is not routinely performed in the ED. Left ventricular hypertrophy is an independent predictor of cardiovascular morbidity and mortality, and hypertension treatment can reduce rates of left ventricular hypertrophy.41 In a retrospective study of 19,434 male patients, ECG left ventricular hypertrophy criteria that incorporated a left ventricular strain pattern, increased negative P-terminal force, and T-wave inversions were most strongly predictive of cardiovascular mortality. No single criterion for left ventricular hypertrophy was found to be optimal, with voltage-only criteria being of low prognostic value.41

In a prospective cohort study of 161 predominantly African American men presenting to the ED with asymptomatic elevated blood pressure, standard criteria for left ventricular hypertrophy on ECG had poor sensitivity (29%) for left ventricular hypertrophy on echocardiogram, and specificity was variable.42 Therefore, the use of routine ECG in patients with asymptomatic elevated blood pressure is questionable. Further studies need to be performed to make conclusions as to the prognostic value of left ventricular hypertrophy in women. However, ECGs are noninvasive, readily available, and inexpensive. Many patients presenting with elevated blood pressure have other complaints that necessitate an ECG and, therefore, despite the poor sensitivity and specificity, emergency clinicians may use ECG as part of their evaluation of a hypertensive patient.

Echocardiogram
Chest x-ray and ECG have poor sensitivity for identifying subclinical heart disease.38 While echocardiogram is often difficult to obtain in the ED and is certainly not part of a routine ED evaluation of hypertension, it is of interest that in a largely black cohort of patients at an urban center in the United States, 90% of the study sample showed signs of subclinical heart disease on echocardiogram. In this study, subclinical heart disease was defined as left ventricular hypertrophy, systolic dysfunction, or diastolic dysfunction.23 While this was in a largely black cohort and may not be applicable to other populations, it underscores the importance of referring pa-

---

Table 7. Emergency Department Laboratory Testing

<table>
<thead>
<tr>
<th>Test</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinalysis</td>
<td>Renovascular hypertension, nephrotic syndrome, nephritic syndrome, pre-eclampsia</td>
</tr>
<tr>
<td>Serum chemistry</td>
<td>Hyperaldosteronism, renal failure</td>
</tr>
<tr>
<td>Electrocardiogram</td>
<td>Left ventricular hypertrophy, left atrial hypertrophy, arrhythmias, myocardial infarction</td>
</tr>
<tr>
<td>Chest radiograph</td>
<td>Pulmonary edema, cardiomegaly, coarctation of the aorta</td>
</tr>
<tr>
<td>Complete blood cell count</td>
<td>Microangiopathic hemolytic anemia</td>
</tr>
<tr>
<td>Urine drug screen</td>
<td>Of very limited utility</td>
</tr>
<tr>
<td>Pregnancy test</td>
<td>Possible pre-eclampsia; avoid angiotensin-converting enzyme inhibitors</td>
</tr>
</tbody>
</table>

Figure 1. Left Ventricular Hypertrophy On Electrocardiogram

Demonstrated here are left ventricular hypertrophy (by voltage criteria: S wave in V2 + R wave in V5 > 35 mm) and left atrial enlargement.
tients with asymptomatic hypertension. Intervening at this branch point may be critical to reducing onset of congestive heart failure and irreversible cardiac remodeling in this high-risk population.

Other Testing

Novel biomarkers are being investigated to demonstrate projected benefit from therapy and adherence to therapy, but they currently have an unclear role in the ED setting.43-47

Treatment

ED treatment of asymptomatic hypertensive patients is complicated by the hesitancy to provide a diagnosis of hypertension in the ED setting and the unclear significance of an isolated elevation in blood pressure. ED-based studies indicate that, of those patients presenting with elevated blood pressure in the ED, only 6% to 8% are diagnosed with hypertension at presentation and a similar percentage are given treatment, prescription, or referral.48,49 This may be because, in 75% percent of these patients, the elevated blood pressure is an incidental finding and not related to the chief complaint.15 There is a sufficient body of evidence to suggest that patients with markedly elevated blood pressure in the ED do have chronic hypertension and their blood pressure is not simply elevated due to anxiety or pain associated with the ED visit.50

Hypertension screening and referral is recommended by ACEP and other organizations.8,16,45,46 Healthy People 2020 (www.healthypeople.gov) cites improved blood pressure control as a major target of their population-wide initiatives.

Compliance with pharmacologic therapy for hypertension can be reinforced in the ED setting. Drug treatment of patients with hypertension has shown the following reductions in risk:1

- > 50% reduction in heart failure risk
- > 35% to 40% reduction in stroke incidence
- 20% to 25% reduction in myocardial infarction

Treatment Thresholds And Pharmacologic Therapies

In the primary care setting, the JNC 8 recommends a blood pressure treatment threshold of 150/90 mm Hg in the > 60 years age group and 140/90 mm Hg in the < 60 years age group, as well as in diabetics and patients with chronic kidney disease.5 First-line antihypertensive medication in nonblack patients should be thiazide-type diuretics, angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), or calcium-channel blockers (CCBs). (See Table 8.) Black patients should be initiated on thiazide-type diuretics or CCB. Patients with chronic kidney disease should be first initiated on an ACEI or ARB. Table 9 summarizes these treatment recommendations. There are no specific recommendations in the JNC 8 on ED-initiated blood pressure management. If a patient presents with uncontrolled hypertension, the first initiated drug should be increased to the maximum permissible dose before initiating a 2-drug regimen.

The JNC 8 treatment threshold remains controversial and many experts argue that medication should be started at a lower threshold. A meta-analysis published in 2013 showed that prehypertension increased the risk of stroke compared with optimal blood pressure control (< 120/80 mm Hg), with a relative risk of 1.66 (95% confidence interval [CI]: 1.51-1.81).27 This increased risk was even more impressive in the high–prehypertension group, defined as > 130/90 mm Hg. Only prospective studies of adult patients were included. The pooled data included 762,393 individuals. While lifestyle modifications remain the mainstay of treatment of patients with blood pressure in this range, it could be argued that it is reasonable to start antihypertensive medications in high-risk patients at a lower threshold than suggested by the JNC 8.

### Table 8. Medication Recommendations For The Management Of Hypertension

<table>
<thead>
<tr>
<th>Population</th>
<th>Treatment Threshold</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>General population</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age ≥ 60 years</td>
<td>SBP ≥ 150 mm Hg or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DBP ≥ 90 mm Hg</td>
<td>• Black patients: thiazide-type diuretic or CCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nonblack patients: thiazide-type diuretic,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCB, ACEI, or ARB</td>
</tr>
<tr>
<td>Age &lt; 60 years</td>
<td>SBP ≥ 140 mm Hg or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DBP ≥ 90 mm Hg</td>
<td>• Black patients: thiazide-type diuretic or CCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nonblack patients: thiazide-type diuretic,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCB, ACEI, or ARB</td>
</tr>
<tr>
<td>Patients with chronic kidney</td>
<td>SBP ≥ 140 mm Hg or</td>
<td></td>
</tr>
<tr>
<td>disease</td>
<td>DBP ≥ 90 mm Hg</td>
<td>• ACEI or ARB</td>
</tr>
<tr>
<td>Patients with diabetes</td>
<td>SBP ≥ 140 mm Hg or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DBP ≥ 90 mm Hg</td>
<td>• Black patients: thiazide-type diuretic or CCB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nonblack patients: thiazide-type diuretic,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCB, ACEI, or ARB</td>
</tr>
</tbody>
</table>

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin-II receptor blocker; CCB, calcium-channel blocker; DBP, diastolic blood pressure; SBP, systolic blood pressure.
The previously discussed 2014 science advisory by the AHA, ACA, and CDC suggests the following treatment: patients with stage 1 hypertension are advised to adopt lifestyle modifications and potentially add a thiazide. Patients with stage 2 hypertension should adopt lifestyle modifications and should be started on dual therapy with a thiazide diuretic in combination with an ACEI, ARB, or CCB.

Emergency Clinician–Initiated Antihypertensive Treatment

In deciding whether to treat elevated blood pressure in the ED, the emergency clinician must consider the risks and benefits. While it is certain that, in the long term, elevated blood pressure increases the risk of neurologic, cardiovascular, and ophthalmologic disease, it is unclear what the short-term risks of elevated blood pressure are. It is also well described that a precipitous decline in blood pressure in a patient with chronically elevated blood pressure is dangerous. Excessively rapid reductions have been related to acute kidney injury, ischemic cardiac or cerebral events, and even retinal artery occlusion and blindness.

In addition, the treating provider must know to expect a drop in blood pressure after the first ED blood pressure check. In a retrospective chart review of 195 patients, Pitts et al found that, among asymptomatic hypertensive patients in the ED, there was an average drop of 11.6 mm Hg in the diastolic value from the first to the second measured blood pressure (where the second measure occurred at least 20 minutes after the first). They hypothesized that most of the effect could be explained by regression to the mean, while part of the effect may be explained by attenuation of an alerting response. In comparison, nonhypertensive individuals in this study saw their diastolic blood pressure reduced by an average of 3.7 mm Hg. It is recommended that emergency clinicians be aware of this effect prior to initiating treatment and verify abnormal initial blood pressures with a second reading.

In a retrospective chart review of patients with severe hypertension, Preston et al reported that, in patients with severe hypertension, 75% of those

| Table 9. Recommended First-Line Medications For Hypertension Management |  |
|---|---|---|---|
| **Drug** | **Oral Starting Dose** | **Oral Target Dose** | **Comments** |
| **Angiotensin-Converting Enzyme Inhibitors (ACEIs)** |  |
| Mechanism of action: Inhibit the formation of angiotensin II, resulting in arterial vasodilation |  |
| Captopril | 50 mg twice daily | 150-200 mg/day in 2 divided doses | • May cause hyperkalemia when used in combination with potassium-sparring diuretics and other drugs that elevate potassium, such as nonsteroidal anti-inflammatory drugs, trimethoprim, and digoxin • May cause chronic cough or angioedema • Treatment of choice in patients with chronic kidney disease and proteinuria |
| Enalapril | 5 mg daily | 20 mg/day in 1-2 divided doses |  |
| Lisinopril | 10 mg daily | 40 mg/day |  |
| **Angiotensin Receptor Blockers (ARBs)** |  |
| Mechanism of action: Block the binding of angiotensin II to receptors, resulting in arterial vasodilation |  |
| Eprosartan | 400 mg daily | 600-800 mg/day in 1-2 divided doses | • May cause hyperkalemia when used in combination with potassium-sparring diuretics and other drugs that elevate potassium, such as nonsteroidal anti-inflammatory drugs, trimethoprim, and digoxin • May be considered for use in patients who are intolerant of ACEIs |
| Candesartan | 4 mg daily | 12-32 mg/day |  |
| Irbesartan | 75 mg daily | 300 mg/day |  |
| Losartan | 25 mg daily | 100 mg/day in 1-2 divided doses |  |
| Valsartan | 40-80 mg daily | 160-320 mg/day |  |
| **Calcium-Channel Blockers (CCBs)** |  |
| Mechanism of action: Block calcium influx into smooth muscle cells, resulting in arterial vasodilation |  |
| Amlodipine | 2.5 mg daily | 10 mg/day | • May cause peripheral and pulmonary edema • Diltiazem may decrease heart rate |
| Diltiazem (extended release) | 120-180 mg daily | 360 mg/day |  |
| **Thiazide-type Diuretics** |  |
| Mechanism of action: Inhibit sodium ion transport in renal tubules, resulting in sodium, chloride and water excretion, leading to decreased plasma fluid volume |  |
| Chlorthalidone | 12.5 mg daily | 25 mg/day | • May cause hyponatremia • Inexpensive • Often part of dual therapy and available in combination with other anti-hypertensive medications • Avoid in patients with gout |
| Hydrochlorothiazide | 12.5-25 mg daily | 50 mg/day in 1-2 divided doses |  |
Clinical Pathway For Management Of Elevated Blood Pressure In The Emergency Department

Elevated BP\(^a\) on initial vital signs

Recheck BP using best possible technique (see Measuring Blood Pressure, page 7) (Class III)

BP normal now?

YES

Recheck BP within 1 month (Class III)

NO

Evidence of acute end-organ damage?

YES

Hypertensive emergency:
- Initiate parenteral therapy
- Admit to monitored setting (Class III)

NO

Hypertensive urgency:
- Inform patient
- Recommend follow-up within 1 week
- Consider initiating, reinitiating, or increasing oral therapy in collaboration with primary care provider
- No need to normalize BP in ED (Class III)

\(^a\)All patients with elevated blood pressure should have it addressed in the clinical decision-making notes or discharge instructions.

Abbreviations: BP, blood pressure; ECG, electrocardiogram; ED, emergency department.

Class Of Evidence Definitions

Each action in the clinical pathways section of *Emergency Medicine Practice* receives a score based on the following definitions.

**Class I**
- Always acceptable, safe
- Definitely useful
- Proven in both efficacy and effectiveness

*Level of Evidence:*
- One or more large prospective studies are present (with rare exceptions)
- High-quality meta-analyses
- Study results consistently positive and compelling

**Class II**
- Safe, acceptable
- Probably useful

*Level of Evidence:*
- Generally higher levels of evidence
- Nonrandomized or retrospective studies: historic, cohort, or case control studies
- Less robust randomized controlled trials
- Results consistently positive

**Class III**
- May be acceptable
- Possibly useful
- Considered optional or alternative treatments

*Level of Evidence:*
- Generally lower or intermediate levels of evidence
- Case series, animal studies, consensus panels
- Occasionally positive results

**Indeterminate**
- Continuing area of research
- No recommendations until further research

*Level of Evidence:*
- Evidence not available
- Higher studies in progress
- Results inconsistent, contradictory
- Results not compelling

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

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treated received clonidine and 16.5% received nifedipine; 32% received dual therapy; and 17% received triple therapy for their hypertension in the ED.55 Currently, there is no evidence to suggest that patients with asymptomatic hypertension — even severely elevated asymptomatic hypertension — should be treated acutely in the ED. There is controversy as to whether prescriptions for antihypertensive medications should be provided on discharge, with some experts arguing for initiation1,6,51,56-58 and others suggesting it is not necessary.4,59,60

Given the prevalence of this disease in the general population, we cannot rely solely on primary care providers to manage uncontrolled hypertension. In addition, for many patients, the emergency clinician may be their only contact with a doctor. While referral for further treatment of chronic hypertension may be preferable, their ED visit may be their only opportunity for counseling, blood pressure checks, and treatment.61

The author recommends that patients with asymptomatic hypertension presenting to the ED setting be counseled. A collaborative approach should be undertaken. Any decision as to the initiation of antihypertensive medications should be discussed with the patient’s primary care physician. A discussion about the need for follow-up and reasons to return to the ED should be initiated with the patient. For patients with severe hypertension, it is reasonable to start an oral blood pressure medication in the ED and discharge the patient with a prescription. If severe hypertension is not present, it is reasonable to arrange follow-up and not initiate any new medication.

In a randomized controlled trial in the United Kingdom, screening of ED patients for hypertension and provision of follow-up material did not lead to new drug treatment for hypertension at 3- and 6-month follow-up, calling into question whether patient education leads to actionable change.62 However, this was a United Kingdom study and may not represent provider practice in the United States.

**Lifestyle Modifications**

The National High Blood Pressure Education Program Coordinating Committee, which includes representatives from the AHA, CDC, and NHLBI, as well as various other organizations, recommends these lifestyle modifications to address hypertension:

- Engage in moderate physical activity.
- Maintain normal body weight.
- Limit alcohol consumption.
- Reduce sodium intake.
- Maintain adequate intake of potassium.
- Consume a diet rich in fruits, vegetables, and low-fat dairy products and reduced in saturated and total fat.63

Lifestyle modifications should be the initial focus of blood pressure management, as put forth in the 2013 Lifestyle Work Group.1,64 Activities such as yoga, taking walks, adopting stress management techniques, and taking ginseng and flaxseed supplements have also shown promise in reducing blood pressure.65-67

### Special Populations

**Racial And Ethnic Disparities**

The CDC analyzed data from the National Health and Nutrition Examination Survey (NHANES) for the years 2003-2010 to examine racial and ethnic differences in hypertension control, awareness, and treatment.68 This is a cross-sectional survey designed to monitor the health and nutrition status of the United States civilian population. The proportion of Mexican American and black populations with stage 1 and 2 hypertension is greater than in whites. In addition, patients belonging to these 2 groups were significantly younger than whites, suggesting that race and ethnicity may be risk factors for earlier development of this disease. However, Mexican American patients are less likely to receive treatment for stage 1 hypertension and less likely to have health insurance coverage. Black patients exhibited the most awareness and received the most treatment, compared with other racial and ethnic groups, but they had the poorest control of their hypertension. Some community-led initiatives have been implemented in an attempt to improve control in black patients and in patients with transportation barriers to usual care.69-71

**Sex Considerations**

In the NHANES sample, men and women had similar awareness and prevalence of hypertension, but women had a higher percentage of controlled hypertension (55.2%) than men (49.3%).72 More women (80.6%) than men (70.9%) reported taking medication for hypertension. As discussed previously, women with high-normal blood pressure may be at greater risk for cardiovascular disease than their male counterparts.25

**Pregnancy**

The management of pregnant women presenting to the ED with hypertension is complicated and should be discussed with the patient’s obstetrician. Hypertension during pregnancy is classified into 4 categories: (1) pre-eclampsia, (2) chronic hypertension (of any cause), (3) chronic hypertension with superimposed pre-eclampsia, and (4) gestational hypertension. In general, pregnant women should receive drug treatment for consistently elevated systolic blood pressure > 160 mm Hg or diastolic blood pressure > 110 mm Hg. First-line treatment includes methyldopa, labetalol, and nifedipine.6,73
Age Differences
In the NHANES data set, 18- to 39-year-olds had the poorest blood pressure control, with 34.4% achieving control versus 57.8% of 40- to 59-year-olds. In addition, awareness of hypertension was lowest in 18- to 39-year-olds, indicating that this group may benefit the most from counseling.72

Controversies And Cutting Edge

Making An Emergency Department Diagnosis Of Hypertension
Multiple studies have addressed the replicability of elevated blood pressures identified in the ED. ED patients frequently have abnormal blood pressure measurements when they present for follow-up testing, calling into question the belief that anxiety or pain falsely elevates blood pressure in these patients and ED measurements are not accurate.12,13,74-76 In a study by Dieterle et al, a blood pressure > 165/105 mm Hg had a sensitivity of 90% for arterial hypertension in follow-up.77 In a study by Fleming et al, patients with the highest pain scores (10/10) had a mean blood pressure increase of 8.4 mm Hg, but in other studies, pain did not appear to contribute to the elevated blood pressure.13 In a prospective cohort study of 189 patients that compared elevated blood pressure taken in the ED with home monitoring of blood pressure over a period of a week, 6% to 8% of patients with blood pressures > 140/90 mm Hg in the ED had normal blood pressure in follow-up, and the presence of anxiety or pain did not predict normalization of elevated blood pressure in follow-up.80

Public Health Considerations
The rate of hospital admission from 2006 to 2009 increased by more than 10% for hypertension, while ED admission decreased by 6.3%.11 Hypertension is considered by the Agency for Healthcare Research and Quality (AHRQ) to be a prevention quality indicator (PQI). PQIs are a measure of potentially avoidable hospitalization for ambulatory care sensitive conditions. They are intended to measure the accessibility and quality of ambulatory care in a given geographic area. The decreased rate of hypertension admission from EDs11 suggest that EDs play a more positive role in preventable hospital admissions than previously believed.

System-Wide Solutions To Address Hypertension
Multiple solutions to address asymptomatic hypertension in the ED have been proposed, including the establishment of dedicated onsite hypertension clinics. In this model, emergency clinicians initiate testing and treatment with the knowledge that all patients would have close follow-up.76 Other proposals include educating providers and supplying feed-

Discharge
Patients with elevated blood pressure and no symptoms should be referred for outpatient follow-up without a specific ED-based intervention. Patients with blood pressure > 160/100 mm Hg should be referred to their primary care provider for re-evaluation within a month. However, outpatient follow-up within a month is often difficult to secure, even for those with primary care physicians; up to one-third are unable to obtain appointments.88,89 In a qualitative study of ED patients, patient-specific barriers to follow-up included the inability to obtain time off from work, forgetfulness, and wait times for appointments, but patients in the study reported that family support and information about the complications of uncontrolled hypertension would increase their likelihood to follow up.100

Discharge instructions should advise patients to return if they experience severe headache, focal weakness or numbness, chest pain, shortness of breath, or any worsening symptoms.

In data derived from 3.9 million ED visits from 2006-2011, rates of ED visits for primary and secondary hypertension have increased, while admissions have decreased by 15% and 12%, respectively.101
ED screening for hypertension was recommended by the Society for Academic Emergency Medicine Public Health and Education Task Force, in addition to multiple other experts. However, currently, many emergency clinicians do not recheck abnormal blood pressures and refer patients for outpatient care. In a retrospective chart review by Frei et al, 2.7% of 149 patients with a blood pressure-related complaint developed a serious outcome by the end of the 7-day follow-up period. Three had congestive heart failure and I developed acute kidney injury. This study is limited by its exclusion of patients whose chief complaint was not hypertension, elevated blood pressure, or high blood pressure. It is conceivable that the actual 7-day event rate is higher, given that many patients seen in the ED setting with elevated blood pressure present for unrelated complaints. In addition, Frei et al only included patients who had morbidity or mortality within their hospital system and it is possible that out-of-state or uninsured patients may have gone elsewhere with complications. The study is also limited by its retrospective nature and small sample size and, in itself, it is insufficient to recommend admission of all patients with elevated blood pressure. Further studies should be completed to examine short- and long-term morbidity and mortality and predictors of poor outcomes.

**Readmission**

Readmission rates for patients admitted for severe hypertension are on the order of 35% in 90 days, placing a significant burden on EDs. Factors found to be predictive of readmission included prior admission for severe hypertension, history of drug abuse, and presentation for shortness of breath or seizure.

In a retrospective chart review by Preston et al, in a select population of ED patients with systolic blood pressure ≥ 220 mm Hg or diastolic blood pressure ≥ 120 mm Hg, 83% of patients were discharged. Of these, 30% returned to the ED for uncontrolled hypertension within an average of 30 days (+/- 28 days) and 14% suffered hypertensive complications (hypertensive encephalopathy, congestive heart failure, stroke, and acute coronary syndromes). This demonstrates that patients presenting to the ED with severe hypertension have a high rate of recurrent ED visits and hypertensive complications.

Therefore, in patients discharged from the ED, there should be a clear follow-up plan or consideration of initiation of an antihypertensive agent. Communication with the patient about the risks of uncontrolled hypertension, lifestyle modifications, and the importance of referral is crucial.

**Summary**

Presentation of patients with elevated blood pressure is a common occurrence in the ED setting and these patients are at risk for long-term morbidity and mortality related to cardiovascular, ocular, and neurological complications. Initial evaluation should be targeted at differentiating between hypertensive emergency and poorly controlled chronic hypertension. Management of patients with elevated blood pressure is complicated by high rates of ED recidivism, poor follow-up rates in primary care offices, difficulty obtaining expedient follow-up, and hesitancy of ED providers to initiate antihypertensive therapy. There are significant gaps in the literature regarding recommended laboratory testing, ED thresholds for initiating therapy, and short- and long-term consequences of admitting versus discharging patients.

**Case Conclusions**

The 52-year-old woman with a prior diagnosis of hypertension who was referred by her primary care provider was counseled on the importance of using her hydrochlorothiazide regularly and told to have her blood pressure rechecked in 1 week’s time at her primary care provider’s office.

You informed your 35-year-old patient that he likely has chronic hypertension. Given his limited access to healthcare, you sent blood for chemistries and obtained an ECG and a chest x-ray. His laboratory results were consistent with acute kidney injury, so you admitted him to the hospital.

According to the JNC 8, in patients aged > 60 years, treatment initiation should begin at a blood pressure of 150/90 mm Hg. Given that your 78-year-old patient was not above this threshold and had reasonable follow-up, counseling on lifestyle interventions was the most appropriate course of action. You counseled her that she may have chronic hypertension and should follow up with her doctor within a month to have her blood pressure rechecked. You advised her that, in the meantime, she should initiate a walking exercise program, reduce her sodium and alcohol intake, and return to the ED if she develops chest pain, shortness of breath, or weakness.

**References**

Evidence-based medicine requires a critical appraisal of the literature based upon study methodology and number of subjects. Not all references are equally robust. The findings of a large, prospective, randomized, and blinded trial should carry more weight than a case report.

To help the reader judge the strength of each reference, pertinent information about the study will be included in bold type following the reference, where available. In addition, the most informative references cited in this paper, as determined by the authors, will be noted by an asterisk (*) next to the number of the reference.
1. “I aggressively treat all patients with elevated blood pressure initially, and then decide who needs to be admitted or discharged based on their response to therapy.”
   It is wise to tailor diagnostic and management strategies to the individual patient and to distinguish patients with asymptomatic elevated blood pressure from those presenting with symptoms that are suggestive of end-organ damage or hypertensive emergency. While the former need a blood pressure recheck in days to weeks, the latter may need parenteral therapy and admission (frequently to the intensive care unit setting). Also, blood pressure that is elevated on initial triage measure may decrease without an intervention on recheck. While patients with asymptomatic elevation of blood pressure have a low likelihood of short-term decompensation, those with hypertensive emergency need parenteral therapy to prevent potentially fatal acute end-organ damage.107

2. “I was reassured by her normal blood pressure in the ED, even though her doctor sent her in for a markedly elevated blood pressure in the office.”
   Proper cuff size avoids underestimation of blood pressure in thin individuals and overestimation of blood pressure in obese individuals. Be aware of this with your thin elderly female patients. A standard adult or large-size cuff may lead to underestimation of their blood pressure in the ED.

3. “I gave him clonidine prior to his discharge. I didn’t think he needed to be admitted.”
   In patients without end-organ hypertension symptoms or signs, discharge from the ED with follow-up for elevated blood pressure is appropriate. It is not advisable to treat these patients in the ED with parenteral or oral therapy to which they are naïve, simply to improve their vital signs while in the department. Drugs such as clonidine are not considered first-line therapy for hypertensive urgency. In patients who may have chronically elevated blood pressure, they can cause a significant drop in blood pressure, leading to a decrease in cerebral blood flow, with consequent syncope or even stroke.3

4. “The patient’s blood pressure was elevated, but she was well-appearing, so I followed the ACEP clinical policy recommendations and didn’t order any laboratory testing.”
   While laboratory testing is not necessary in most patients presenting with symptomatic elevated blood pressure, patients should be screened for end-organ damage and the concerning causes of elevated blood pressure. All women of childbearing age should be asked if they are pregnant or recently gave birth. Undiagnosed pre-eclampsia can lead to renal failure, liver failure, seizures, and cardiovascular morbidity.


5. “The patient was here for a paronychia, I didn’t feel the need to scrutinize his high blood pressure.”

Patients frequently present with elevated blood pressure without symptoms. Hypertension is a widely prevalent disease and there can be a long latency from onset to development of end-organ damage. The ED offers a public health opportunity for early diagnosis, counseling, and referral.

6. “I didn’t address the patient’s elevated blood pressure of 180/100 mm Hg because I assumed that it was due to anxiety from being in the ED.”

Numerous studies support the replicability of ED blood pressures (particularly those above 160/100 mm Hg) in the outpatient setting. Blood pressure measurements should be repeated in these patients, and they should be informed of their abnormal blood pressure readings and receive expedient follow-up, with consideration for a prescription for a first-line antihypertensive medication.

7. “I didn’t counsel the patient on lifestyle strategies to decrease his elevated blood pressure because this is the role of the primary care provider.”

Many of our patients do not have a source of regular primary care or they have long waits to be seen by their primary care providers. Lifestyle changes are a benign, cost-effective, and efficacious means of decreasing blood pressure.

8. “A complete laboratory workup showed no abnormalities, so I felt comfortable discharging her.”

The ACEP clinical policy asserts that patients presenting with elevated blood pressure without a history or examination suggestive of hypertensive emergency need not have extensive laboratory investigations in the ED.7

9. “Other than referring patients with elevated blood pressure and no symptoms, there’s really nothing I feel I can do.”

Many patients may benefit from restarting or increasing the dose of their current blood pressure medication. It is helpful to review over-the-counter and prescription medications with the patient, such as decongestants, steroids, NSAIDs, appetite suppressants, and other medication that can temporarily raise blood pressure.108 Acute blood pressure lowering is not advisable. Changes in blood pressure medications should be coordinated with the primary physician whenever possible.

10. “I wrote him a prescription for lisinopril because I was comfortable with the dosing and I couldn’t reach his primary care provider.”

Prior to starting a new prescription in a patient, the JNC 7 advises obtaining a baseline blood chemistry. It is also critical to review the patient’s other medications to avoid dangerous drug interactions. In patients on potassium supplements or potassium-sparing diuretics, the addition of an ACEI may cause hyperkalemia.
Cost-Effective Strategies

- Diagnose the hypertension.
  Patients with elevated blood pressure should be told they might have hypertension and how to follow up with their primary care provider. Lifestyle modifications and drug therapy reduce the risk of target-organ damage. Prevention is more cost-effective than treating the consequences of long-term uncontrolled hypertension. Patients need clear discharge instructions that detail when to follow up and when to return to the ED.

- Remember first-line therapies.
  A significant proportion of ED patients use the ED as their exclusive site of care. Providers should be aware of the recommended first-line treatment of hypertension. At the very least, lifestyle modifications should be recommended, but, in many cases, particularly those with systolic blood pressure > 160 mm Hg or diastolic blood pressure > 100 mm Hg, patients will need drug therapy to reduce their blood pressure. Be familiar with the starting doses of thiazide diuretics, ACEIs, ARBs, and CCBs. Simple regimens of inexpensive medications, such as thiazides, improve adherence. In addition, rescheduling therapy to before bedtime rather than mornings can improve control and adherence. Avoid starting patients without insurance on expensive combination regimens.

- Promote adherence.
  Counsel patients on the risks of uncontrolled hypertension and the need for daily adherence to their drug regimen. An understanding of the disease and its consequences will help promote adherence. Home monitoring of blood pressure using home blood pressure devices has been shown to improve blood pressure control and is inexpensive.

76. Slater RN, DaCruz DJ, Jarrett LN. Detection of hypertension in accident and emergency departments. Arch Emerg Med. 1987;4(1):71-75. (Prospective observational; 60 patients)
CME Questions

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1. Which of the following clinical scenarios qualifies as a hypertensive emergency?
   a. A 23-year-old woman who is 30 weeks pregnant with a blood pressure of 140/95 mm Hg and no proteinuria
   b. A 56-year-old man with a history of poorly controlled hypertension who presents with a finger fracture and is found to have a blood pressure of 195/120 mm Hg in triage
   c. A 58-year-old woman with an aortic dissection who presents with tearing chest pain radiating to the back and a blood pressure of 180/120 mm Hg
   d. An asymptomatic 65-year-old man with no medical history who is sent in from a health fair with a blood pressure of 200/120 mm Hg

2. Which of the following cut-offs describe stage 1 hypertension?
   a. Blood pressure < 120/80 mm Hg
   b. Blood pressure 120-139 mm Hg systolic or 80-89 mm Hg diastolic
   c. Blood pressure 140-159 mm Hg systolic or 90-99 mm Hg diastolic
   d. Blood pressure ≥ 160 mm Hg systolic or ≥ 100 mm Hg diastolic

3. Among United States patients with hypertension, what is the rate of uncontrolled hypertension?
   a. 20%
   b. 30%
   c. 40%
   d. 50%

4. Which of the following tests must be performed on every patient presenting to the ED with a blood pressure > 180/120 mm Hg?
   a. Serum chemistry
   b. Complete blood count
   c. Urinalysis
   d. Urine drug screen
   e. None of the above

5. According to the ACEP clinical policy on asymptomatic hypertension, which of the following patients may benefit from laboratory testing in the ED setting?
   a. A 40-year-old woman with a blood pressure of 150/80 mm Hg who is asymptomatic and has a primary care provider she sees regularly
   b. A 29-year-old man with a blood pressure of 180/100 mm Hg who is homeless
   c. A 58-year-old woman with a blood pressure of 200/120 mm Hg and no health insurance coverage
   d. B and C

6. Drug treatment for hypertension does not decrease the risk of stroke, coronary artery disease, or congestive heart failure.
   a. True
   b. False

7. ACEIs are associated with which of the following side effects?
   a. Angioedema
   b. Cough
   c. Hyperkalemia
   d. All of the above

8. Hypertensive urgency requires normalization of blood pressure prior to leaving the ED.
   a. True
   b. False

9. An excessively large blood pressure cuff on a small adult will lead to which of the following?
   a. An overestimation of the patient’s blood pressure
   b. An underestimation of the patient’s blood pressure

10. What medication is not considered first-line therapy for hypertension?
    a. Lisinopril
    b. Chlorthalidone
    c. Amlodipine
    d. Clonidine
Emergency Department Management Of The Alcohol Withdrawal Syndrome

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Alcoholism is a prevalent medical and psychiatric disease and, consequently, alcohol withdrawal syndrome is encountered frequently in emergency departments. Uncomplicated alcohol withdrawal, or alcohol withdrawal tremor, is the most common and least severe manifestation of alcohol withdrawal syndrome; it can commonly be managed on an outpatient basis with oral benzodiazepines. Alcohol withdrawal seizure and alcoholic hallucinosis are the first manifestations of so-called complicated alcohol withdrawal. They generally signify the need for inpatient alcohol detoxification and, often, the use of intravenous benzodiazepines. Alcohol withdrawal tremor and alcoholic hallucinosis are the first manifestations of so-called complicated alcohol withdrawal. They generally signify the need for inpatient alcohol detoxification and, often, the use of intravenous benzodiazepines. Delirium tremens is the most severe and life-threatening form of alcohol withdrawal. The key diagnostic criteria for delirium tremens are an alteration in awareness or attention (delirium) and tremor. Patients commonly manifest hyperadrenergic signs and symptoms that necessitate intensive care unit admission, intravenous benzodiazepines, and, frequently, adjunctive pharmacotherapy. An aggressive front-loading approach with benzodiazepines is proposed and the management of benzodiazepine-resistant disease is addressed.

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Diagnosis And Management Of Deep Vein Thrombosis In The Emergency Department

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Concern for deep vein thrombosis is common in the emergency department, but the clinical presentations of deep vein thrombosis are notoriously subtle and nonspecific. Contemporary diagnostic evaluations of deep vein thrombosis are rendered more efficient by the use of risk stratification tools, primarily the Wells Clinical Score, which can guide the clinician down several pathways, including D-dimer assays and/or ultrasonography. The treatment of deep vein thrombosis includes multiple options for anticoagulation, with new oral anticoagulants offering alternatives to the traditional methods. This article reviews the current literature, evidence, and recent guideline recommendations in the diagnosis and management of deep vein thrombosis. It also explores some of the controversies and developments regarding special populations, adjusted D-dimer thresholds, isolated distal deep vein thrombosis, upper extremity deep vein thrombosis, and outpatient treatment.

Emergency Department Management Of The Alcohol Withdrawal Syndrome

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