

# Hospital Medicine Practice

Empowering Hospitalists  
With Evidence-Based Reviews

## Hospital Management Of Hypertension: Essential And Secondary Hypertension

The hospitalist plays a vital role in the clinical decision-making for patients with hypertension. The hospitalist will encounter the hypertensive patient in a variety of clinical settings; however, established guidelines for the management of hypertension in the hospitalized patient do not exist. Direct extrapolation of the management of the outpatient clinic patient from the Joint National Committee guidelines (JNC 7 and JNC 8) may not be appropriate for the hospitalized patient. A hospitalized patient's coexisting medical conditions should be considered when treating episodic hypertension. When encountering patients with undiagnosed hypertension, the decision to initiate therapy should be guided by the patient's access to medications and the availability and likelihood of follow-up on discharge. This issue reviews the existing evidence, where available, to guide the hospitalist through the management of hypertension in the hospitalized patient.

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### Author

#### Sean E. Ervin, MD, PhD

Assistant Professor of Pediatrics and Internal Medicine, Hospitalist Section, Department of Pediatrics, Wake Forest Baptist Medical Center, Winston-Salem, NC

### Peer Reviewers

#### Roselyn Cristelle I Mateo, MD

Assistant Professor and Attending Physician, Department of Internal Medicine, Section of Hospital Medicine, Rush University Medical Center, Chicago, IL

#### Alpesh N. Amin, MD, MBA, MACP, SFHM

Thomas & Mary Cesario Endowed Chair of Medicine, Professor of Medicine, Business, Public Health, Nursing Science & Biomedical Engineering, Executive Director, Hospitalist Program, University of California – Irvine, Irvine, CA

### CME Objectives

Upon completing this article, you should be able to:

1. Discuss the prevalence, pathophysiology, and epidemiology of hypertension in the hospitalized patient.
2. List management issues for hypertension specific to the hospitalist.
3. Describe the role of the hospitalist in discharging the patient with new antihypertensive medications.

*Prior to beginning this activity, see "Physician CME Information" on the back page.*

### Editor-in-Chief

**Alpesh N. Amin, MD, MBA, MACP, SFHM**  
Thomas & Mary Cesario Endowed Chair of Medicine  
Professor of Medicine, Business, Public Health, Nursing Science & Biomedical Engineering  
Executive Director, Hospitalist Program  
University of California – Irvine, Irvine, CA

### Clinical Pearls Contributor

**David J. Rosenberg, MD, MPH, FACP, SFHM**  
Chief, Division of Hospital Medicine, North Shore LIJ Department of Medicine, Associate Professor of Medicine, Hofstra North Shore LIJ School of Medicine, Hempstead, NY

### Charting Contributor

**James B. Haering, DO, SFHM**  
Associate Professor of Medicine, Michigan State University College of Osteopathic Medicine and Michigan State University College of Human Medicine, East Lansing, MI

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### Nejat Zeyneloglu, MD

Medical Director, Hospital Medicine Program, New York Hospital Queens, Weill-Cornell Medical College, New York, NY

### Pharmacology Contributor

**James Damilini, PharmD, MS, BCPS**  
Clinical Pharmacy Specialist, Emergency Medicine, St. Joseph's Hospital and Medical Center, Phoenix, AZ



## Clinical Pearls

### Epidemiology (Page 4)

- Hypertension (HTN) is prevalent in the hospitalized patient population (50%).
- New HTN is identified in many inpatients (20%-30%).
- Blood pressure (BP) often remains uncontrolled at discharge (45%).

### Key Terms (Page 4)

- Hypertension: BP > 140/90 mm Hg
- Essential hypertension: HTN without an identifiable secondary cause
- Secondary hypertension: HTN with identifiable cause
- Hypertensive crisis: A hypertensive emergency or urgency
- Hypertensive emergency: BP > 180/120 mm Hg, with end-organ dysfunction
- Hypertensive urgency: BP > 180/120 mm Hg, without end-organ dysfunction

### Guidelines (Page 4)

- The evidence-based guidelines, JNC 7 and JNC 8, do not discuss inpatient HTN management.
- There is no evidence that treatment of HTN in the acute hospital setting confers mortality or morbidity benefit or even if elevated BP is of significant risk (except when there is acute end-organ damage).
- Failure to prescribe antihypertensive medications at the time of discharge correlates with nontreatment at 6 to 18 months in outpatient follow-up visits.

### History And Physical Examination (Page 5)

- Determine the duration of hypertension and length of pharmacologic therapy.
- Identify recent changes to medications and the presence of comorbid medical conditions (diabetes mellitus, chronic kidney disease, cardiovascular disease, cardiovascular accident).
- Identify back pain, dyspnea, or neurologic symptoms.
- Use the proper technique for measuring BP.
- Do not order any diagnostic tests unless indicated for other clinical reasons.

### Differential Diagnosis (Page 5)

- Evaluate for anxiety, pain, and fluid overload.
- Secondary causes of HTN are uncommon (< 5%).
- Renal artery stenosis is the main nonendocrine cause.
- Endocrine causes of HTN may be due to disorders of the thyroid, parathyroid, adrenal, and pituitary glands.
- Recognize primary hyperaldosteronism in the context of hypertension, hypokalemia, and metabolic alkalosis.
- Evaluate difficult-to-control HTN for secondary cause of HTN in the presence of:
  - Age < 30 years.
  - Patient taking  $\geq 3$  antihypertensive medications.
  - Sudden change in previously well-controlled HTN.
  - Evidence of renovascular disease (elevated creatinine, proteinuria on urinalysis, or renal bruits on examination).
  - Evidence of endocrinological basis for hypertension (eg, glucocorticoid excess, hypokalemia with

metabolic alkalosis, hyperthyroidism, hyperparathyroidism, suspicion of pheochromocytoma, or other secretory tumors).

### Treatment (Page 8)

- Rule out and treat pain, anxiety, or volume overload before initiating or adjusting antihypertensive treatment.
- Keep in mind that risk of hypotension from treatment may outweigh any benefits:
- Avoid treating episodes of mild or moderate BP elevation in the absence of end-organ effects.
- Do not prescribe intravenous antihypertensive medications for episodes of mild or moderate BP elevation in the absence of end-organ effects.
- Prescribe intravenous treatment for hypertensive emergencies or when patients are NPO (nothing by mouth).
- Treat essential HTN with oral medications consistent with most recent guidelines:
  - Elderly patients: thiazide diuretic, CCB, ACEI, or ARB.
  - Black patients: thiazide diuretic or CCB.
  - Diabetic patients: thiazide diuretic, CCB, ACEI, or ARB.
  - Patients with heart failure: ACEI or ARB, beta blocker, aldosterone antagonist.
  - Pregnant patients: methyldopa or labetalol. Avoid ACEI/ARB, atenolol, hydrochlorothiazide, diazoxide, and nimodipine because of their adverse effects in pregnancy.
  - Opt for once-daily medication whenever possible.
- Know the long-term outpatient treatment targets (JNC 8).
  - General population aged  $\geq 60$  years: BP < 150/90 mm Hg.
  - General population aged < 60 years: BP < 140/90 mm Hg.
  - Patients with diabetes or CKD: < 140/90 mm Hg.
  - Prior to discharge, reintroduce antihypertensive agents that were held on admission to ensure they are tolerated.

### Quality Improvement (Page 10)

Ensure well-planned transitions to postdischarge care:

- Complete a thorough medication reconciliation.
- Communicate medication additions and changes directly with the primary care physician.
- Provide patient education, and use teach-back methods with patients regarding their medications and their indications.
- Plan follow-up phone calls postdischarge; direct visits to the patient home may benefit high-risk populations
- Arrange outpatient follow-up within 1 to 2 weeks for all patients after HTN treatment initiation or dose adjustment.

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium-channel blocker; CKD, chronic kidney disease; HTN, hypertension; JNC, Joint National Committee.

## Case Presentation

You have been called to the emergency department to assess a patient for admission. He is a 45-year-old white man with mild hypoxemia. His past medical history is notable for known HIV disease for 5 years, which appears to be controlled well with antiretroviral therapy. Due to fever and hypoxemia, you admit him for management. The physical examination reveals an overweight man, nontoxic in appearance. His measured blood pressure is 160/100 mm Hg. In the admitting orders you write: hydralazine 10 mg intravenous q6h PRN for systolic blood pressure > 160 mm Hg. You ask yourself: Is this approach supported by the current evidence? What are the goals of blood pressure management in the inpatient setting? When is acute intervention indicated? What drugs are available for the management of elevated blood pressure? What are your considerations in this patient's management in addition to addressing his acute infectious illness? How will you transition the patient to the outpatient setting after discharge?

## Introduction

Hypertension is common in the United States, with a current prevalence estimated at 37% for men and 40% for women.<sup>1,2</sup> As such, hypertension is a comorbid medical condition present in as many as 37% of hospitalized patients.<sup>3</sup> Rates of uncontrolled hypertension in the general population remain high, with 40% to 60% of persons with hypertension uncontrolled at the currently recommended levels.<sup>3,4</sup> Hypertension is the most common cardiovascular disease in the United States, and it is the initial clinical insult leading to progressive heart failure and coronary artery disease. It remains the most important risk factor for cardiovascular disease and mortality.

Hospital physicians have the complex task of addressing the management of hypertension in the context of the hospital environment. Practice parameters for the management of hypertension in the outpatient setting exist as evidence-based guidelines: the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC 7)<sup>5</sup> and the 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults (JNC 8).<sup>6</sup> Notably, except for the management of acute stroke, evidence-based guidelines for the management of hypertension in the inpatient setting are not well described. Herzog et al have proposed an algorithm for the management of in-hospital hypertension.<sup>7</sup> They have made recommendations for the medical management of newly diagnosed hypertension in the hospital, proposed diagnostic testing for secondary causes of hypertension, and summarized the existing treatment of acute hypertensive emergen-

cies (acute aortic syndrome and acute neurologic syndrome). Their recommendations refer to blood pressure parameters for treatment of moderate and severe elevations of blood pressure that are not based on the JNC 7 recommendations. The drugs chosen for their treatment algorithms are common drugs used parenterally for the acute management of blood pressure, but no supporting rationale for their decision-making is given.<sup>7</sup>

Currently, the management of hypertension in the hospitalized patient appears to reflect individual physician decision-making and personal beliefs about hypertension in the context of the following general clinical settings. Patients fall into 4 general categories:

1. **Patients with pre-existing hypertension who are admitted for management of other medical comorbidities.** In these cases, the focus is on continuing prescribed therapy, with adjustment of medications as indicated by the clinical presentation (eg, hypotension, acute kidney injury).
2. **Patients who are found to have elevated blood pressures during an acute dynamic hospitalization.** This circumstance can occur in a patient with a new diagnosis of hypertension or in a patient that is normotensive and experiencing anxiety, pain, substance use, or withdrawal, which may cause transient elevations in blood pressure.
3. **Patients who have other conditions that would be encountered by the hospitalist in consultation.** This category includes the perioperative management of hypertension in the surgical patient and hypertension in the pregnant patient.
4. **Patients with pre-existing hypertension who are admitted with acute elevations of blood pressure.** These include conditions such as a neurologic stroke associated with hypertension, cardiovascular complications (such as aortic dissection or aneurysm), or other causes of hypertensive emergency. In these cases, management decisions are dictated by the degree of elevation of the blood pressure and the commonly utilized pharmacologic and management strategies.

Each of these patient categories presents a unique challenge to the hospitalist. This issue of *Hospital Medicine Practice* will review the common practices and, when available, evidence-based practice for hospital management of hypertension in the context of essential hypertension. Emergent medical conditions, including acute ischemic stroke, hemorrhagic stroke, aortic dissection, and hypertension in the pregnant patient are beyond the scope of this issue. Hypertensive urgencies and emergencies are covered in detail in the November 2014 issue of *Hospital Medicine Practice*, "Hospital Management Of Hypertension: Urgencies And Emergencies," at

[www.hmpractice.com/HTNemergencies](http://www.hmpractice.com/HTNemergencies). For more information on hypertensive urgencies in pregnant patients, see the July 2014 issue of *Hospital Medicine Practice*, "Evidence-Based Diagnostic And Treatment Strategies For Pregnant Patients With Hypertensive Disorders," at [www.hmpractice.com/HTNpregnancy](http://www.hmpractice.com/HTNpregnancy).

The hospitalist's decision to treat elevated blood pressure in the hospitalized patient reflects the knowledge that hypertension contributes to overall cardiovascular risk and a desire to "treat the numbers." In the absence of specific institutional guidelines and treatment algorithms, decisions made by hospitalists in the hospital environment will likely be based on an understanding of the guidelines presented in the JNC consensus guidelines.<sup>5,6</sup>

Weder makes the observation that, for many physicians, the blood pressure threshold for making medication adjustments in hospitalized patients corresponds to Stage 2 hypertension as defined in the JNC 7 and JNC 8 (ie, blood pressure > 160/100 mm Hg).<sup>3</sup> The JNC 7/JNC 8 guidelines relevant to Stage 2 hypertension recommend evaluation and referral for follow-up within 1 month in the outpatient setting, but it makes no specific recommendations for the management of the hospitalized patient. It is not clear whether applying these outpatient criteria is appropriate for the hospitalized patient. There is currently no evidence that treatment of hypertension in the acute hospital setting confers long-term mortality or morbidity benefit or that, in the absence of end-organ damage, acute elevation of blood pressure is of significant risk. Even for patients with hypertensive urgency and emergency, 2 separate meta-analyses did not have enough randomized controlled trial evidence to determine whether different classes of antihypertensives had a morbidity or mortality benefit.<sup>8,9</sup>

Much of our experience in the management of acute elevations of blood pressure is derived from the emergency medicine literature.<sup>10</sup> There are some data that hint at the role that hospitalists may play. It has been shown that failure to prescribe antihypertensive medications at the time of discharge from the hospital correlates with nontreatment at 6 to 18 months in outpatient follow-up visits.<sup>11</sup> This observation implies a role for the hospitalist in managing the continuum of care between the hospital and the outpatient setting. This review discusses what is known about the role of the hospital physician in the management of hypertension in the hospitalized patient as it relates specifically to benign essential hypertension, recognition of secondary causes of hypertension and other less common causes of hypertension, and hypertension in the perioperative setting and in the pregnant patient.

## Critical Appraisal Of The Literature

The literature review was limited to a PubMed search using the search terms *inpatient management of hypertension* and *hospital management of hypertension*, with a review of associated bibliographic citations, when relevant. No relevant clinical trials were identified. There is a paucity of literature specifically associated with the management of the asymptomatic hypertensive patient in the inpatient setting.

## Definitions

The definition of hypertension and its associated states has evolved with an increasing awareness of the association of hypertension with cardiovascular disease. The most current definitions associated with the JNC 7 are from 2003. These definitions are unchanged in the JNC 8. (See Table 1.)

## Epidemiology

The prevalence of hypertension in the United States is estimated to be approximately 30% to 40% of the adult population.<sup>3,12</sup> The estimated prevalence of hypertension in hospitalized patients ranges from 50% to 72%. A systematic review by Axon et al, which focused on 9 articles (3 studies of patients in the United States, and 6 studies of patients in Europe) showed that a new diagnosis of hypertension

**Table 1. Definitions Of Hypertension**

Category	Definition
Hypertension	Blood pressure > 140/90 mm Hg*
Essential hypertension	Hypertension without an identifiable secondary cause
Secondary hypertension	Hypertension related to an identifiable cause (ie, adrenal disease, renal artery stenosis, drug effects, withdrawal)
Hypertensive crisis	A hypertensive emergency or urgency
Hypertensive emergency	Blood pressure > 180/120 mm Hg, impending or progressive end-organ dysfunction
Hypertensive urgency	Blood pressure > 180/120 mm Hg, no evidence of end-organ dysfunction
Hypertension, stage 1	SBP 140-159 mm Hg or DBP 90-99 mm Hg
Hypertension, stage 2	SBP ≥ 160 mm Hg or DBP ≥ 100 mm Hg

\*For patients aged ≥ 60 years, JNC 8 recommends initiating antihypertensive treatment at SBP ≥ 150 mm Hg and/or DBP ≥ 90 mm Hg.

Abbreviations: DBP, diastolic blood pressure; JNC, Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; SBP, systolic blood pressure.

occurred in 30% of hospitalized patients.<sup>12</sup> They also examined the introduction of new medications for the management of hypertension at discharge, and described a limited tendency to intensify antihypertensive regimens in hospitalized patients with uncontrolled hypertension.<sup>12</sup> In a similar study, 44% of patients admitted to the hospital with hypertension remained uncontrolled to < 160/90 mm Hg at the time of discharge.<sup>13</sup> The relevance of the older studies and the European studies to the current practice in the United States is unclear, but they serve to underscore these points: (1) hypertension is prevalent in the hospitalized patient population (40%-60%); (2) a new diagnosis of hypertension is identified in approximately 20% to 30% of hospitalized patients; and (3) at discharge, blood pressure in 40% to 50% of these patients remain uncontrolled.

## Pathophysiology

The JNC guidelines emphasize the importance of blood pressure control for managing overall cardiovascular disease risk.<sup>5,6</sup> The relationship between hypertension and the risk of cardiovascular disease is well established. Blood pressure that is above normal is associated with an increased risk for dysrhythmia (atrial fibrillation), myocardial infarction, heart failure, stroke, and kidney disease. Control of blood pressure will lead to an approximately 50% reduction in the risk of congestive heart failure, a 40% reduction in stroke events, and a 20% to 25% reduction in acute myocardial infarction events. The impact of hypertension on cardiovascular disease is exacerbated by the increasing incidence of type 2 diabetes mellitus, chronic kidney disease, hyperlipidemia, and obesity, with which hypertension may co-occur. Some 30% to 65% of patients with hypertension are obese. Diabetes mellitus (types 1 and 2) and the syndrome of insulin resistance co-occur with hypertension in 15% to 25% of patients. Aggressive blood pressure control is advocated for patients with diabetes, due to their increased risk of developing renal disease (2-fold greater risk) and cardiovascular disease (3-fold greater risk) when compared to nondiabetics.<sup>14,15</sup>

## Initial Evaluation

The initial history and physical examination should be directed at determining whether the patient is demonstrating a hypertensive emergency.

### History

History-taking should determine the duration of the patient's hypertension and the length of pharmacologic therapy. Recent changes to medications and the presence of comorbid medical conditions (diabetes, chronic kidney disease, cardiovascular disease, history of stroke) should be determined.

The review of systems should establish the presence of chest pain, back pain, dyspnea, or neurologic complications (such as loss of consciousness or seizures). Positive findings could be suggestive of aortic disease (dissection), acute coronary syndromes, pulmonary edema, heart failure, or an acute neurologic syndrome.

## Physical Examination

The physical examination should be directed at determining the presence of end-organ disease that necessitates urgent blood pressure lowering. Accurate measurement of the blood pressure is obtained with the patient at rest, and it is best taken in both arms if there is suspicion for aortic dissection. Examination of the heart and lungs should focus on findings suggestive of heart failure or myocardial ischemia, including increased jugular venous pressure, S3 or gallop rhythm, and crackles/rales. The neurologic examination should assess for evidence of encephalopathy or focal neurologic deficits. Fundoscopic examination may demonstrate evidence of neuroretinopathy; and papilledema, flame hemorrhages, or exudates are findings that are consistent with hypertensive emergency. There is no recommendation for ancillary testing when managing acute hypertensive episodes in the hospitalized patient, unless it is indicated for other clinical reasons.

## Differential Diagnosis

The differential diagnosis for elevated blood pressure must include consideration of secondary causes of hypertension. Secondary causes of hypertension account for < 5% of all cases. A complete review of the secondary causes of hypertension is outside the scope of this discussion, but the reader is referred to the American Association of Clinical Endocrinologists (AACE) Medical Guidelines for Clinical Practice for the Diagnosis and Treatment of Hypertension (AACE Guidelines 2006) for a more detailed discussion of these diagnoses.<sup>14</sup>

Renal artery stenosis is the main cause of secondary hypertension not involving the endocrine system. Endocrine causes of hypertension may be associated with disorders of the thyroid, parathyroid, adrenal, and pituitary glands, and (rarely) a renin-secreting tumor. Primary hyperaldosteronism may be the cause of hypertension in up to 15% of patients, and it should be considered in the context of hypertension, hypokalemia and metabolic alkalosis. When encountered in the context of difficult-to-control hypertension, the following factors should provoke consideration of a secondary cause of hypertension:

- Young age of presentation (< 30 years)
- Poor control of hypertension with  $\geq 3$  antihypertensive medications

- Sudden change in previously well-controlled hypertension
- Elevated creatinine, abnormal urinalysis with proteinuria, or renal bruits on physical examination (eg, evidence of renovascular disease, such as renal artery stenosis)
- Evidence of endocrinological basis for hypertension, such as glucocorticoid excess, hypokalemia with increased urinary excretion of potassium and metabolic alkalosis, hyperthyroidism (thyroid storm) or hyperparathyroidism, or evidence of pheochromocytoma or other tumor conditions (eg, multiple endocrine neoplasia type 2)

**Table 2** summarizes the major conditions associated with secondary causes of hypertension and their initial workup and management.

## Special Circumstances

### Initiation Of Therapy In The Acute Setting

The overall length of stay for patients with all illness states and acute hypertension is increased by 6 to 8 days when compared to patients admitted with normal blood pressures. The decision to institute oral medication therapy in these patients prior to discharge will depend on a number of factors, including patient access to medications and patient access to outpatient follow-up within 1 to 2 weeks. Adopting a simplified, stepwise approach to managing untreated hypertension as advocated by the STICH (Surgical Treatment for Ischemic Heart Failure) trial may not be an unreasonable strategy for the hospitalist.<sup>15</sup> The hospitalist must communicate directly with the primary care physician in

**Table 2. Causes And Management Of Secondary Hypertension**

Major Cause	Signs and Symptoms	Laboratory Studies / Imaging Modalities	Treatment Strategy
<ul style="list-style-type: none"> <li>• Renovascular hypertension</li> <li>• Renal artery stenosis (atherosclerotic, fibromuscular)</li> </ul>	<ul style="list-style-type: none"> <li>• Difficult-to-control hypertension</li> <li>• Severe hypertension</li> <li>• Epigastric bruit</li> <li>• Significant azotemia associated with ACEIs or ARBs</li> <li>• Unexplained renal insufficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Duplex ultrasound</li> <li>• Magnetic resonance angiography</li> <li>• CT angiography (helical or spiral)</li> <li>• Plasma renin activity</li> </ul>	<ul style="list-style-type: none"> <li>• Vascular surgery consult</li> <li>• Percutaneous renal artery angioplasty</li> <li>• Renal artery stenting</li> <li>• Aggressive blood pressure control, lipid lowering, smoking cessation, antiplatelet therapy</li> </ul>
Cushing syndrome	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Glucose intolerance</li> <li>• Rounded face (moon facies)</li> <li>• Weakness</li> <li>• Easy bruising</li> <li>• Obesity or weight gain</li> <li>• Decreased libido</li> <li>• Depression</li> <li>• Buffalo hump</li> <li>• Striae</li> </ul>	<ul style="list-style-type: none"> <li>• Urinary free cortisol (falsely elevated in renal disease)</li> <li>• Late-night salivary cortisol</li> <li>• Dexamethasone suppression test</li> <li>• Adrenal CT scan</li> <li>• Pituitary MRI</li> </ul>	<ul style="list-style-type: none"> <li>• Endocrinology consult and medical therapies to lower cortisol (metyrapone, ketoconazole)</li> <li>• Tumor-specific surgery</li> <li>• Adrenal surgery</li> <li>• Pituitary radiotherapy</li> </ul>
Hyperaldosteronism	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Headaches</li> <li>• Muscle weakness</li> <li>• Polyuria</li> </ul>	<ul style="list-style-type: none"> <li>• Serum aldosterone/plasma renin ratio</li> <li>• Hypokalemia</li> <li>• Metabolic alkalosis</li> <li>• Abdominal CT</li> </ul>	<ul style="list-style-type: none"> <li>• Surgical excision</li> <li>• Medical management with sodium restriction and aldosterone antagonist</li> </ul>
Pheochromocytoma	<ul style="list-style-type: none"> <li>• Paroxysmal hypertensive crises</li> <li>• Increased metabolic rate (profuse sweating, weight loss, flushing, headache)</li> </ul>	<ul style="list-style-type: none"> <li>• 24-hour urine assay for unconjugated catecholamines and metanephrines, vanillylmandelic acid</li> <li>• CT imaging to localize the tumor</li> </ul>	<ul style="list-style-type: none"> <li>• Alpha-adrenergic blockade (phenoxybenzamine)</li> <li>• Surgical excision</li> </ul>
Thyroid disorders	<ul style="list-style-type: none"> <li>• Bradycardia/tachycardia</li> <li>• Cold/heat intolerance</li> <li>• Irregular menses</li> <li>• Constipation/diarrhea</li> </ul>	<ul style="list-style-type: none"> <li>• TSH, FT4, T3</li> <li>• Thyroid scan and uptake</li> </ul>	<ul style="list-style-type: none"> <li>• Endocrinology consult</li> <li>• Levothyroxine</li> <li>• Methimazole</li> <li>• Propylthiouracil</li> </ul>
Obstructive sleep apnea	<ul style="list-style-type: none"> <li>• Daytime sleepiness</li> <li>• Snoring</li> <li>• Apnea</li> </ul>	<ul style="list-style-type: none"> <li>• Polysomnography</li> <li>• Sleep apnea clinical score with nighttime pulse oximeter</li> </ul>	<ul style="list-style-type: none"> <li>• Pulmonology consult</li> </ul>

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; CT, computed tomography; FT4, free thyroxine; MRI, magnetic resonance imaging; T3, triiodothyronine; TSH, thyroid-stimulating hormone.

this case to ensure timely follow-up and appropriate supervision in the outpatient setting. In the absence of scheduled, timely follow-up, it may be prudent to withhold introducing new medications in patients discharged from the hospital.

### **Factors Influencing Management Of Hypertension In The Acute Setting**

The literature is unclear whether the acute management of episodic asymptomatic hypertension in the hospitalized patient is useful. However, it is not uncommon to see patients admitted to the hospital with orders for the “as needed” administration of antihypertensive medications for episodic hypertension (systolic blood pressure [SBP] > 160 mm Hg and/or diastolic blood pressure [DBP] > 100 mm Hg). Hydralazine and labetalol are parenterally administered drugs used commonly for the management of episodic hypertension. Weder and Erickson estimated that, of patients admitted with the diagnosis of hypertension, 75% received at least 1 dose of hydralazine and 56% received at least 1 dose of labetalol intravenously for episodic hypertension.<sup>16</sup> One-third of patients with hypertension received both drugs. This treatment came at the cost of increased length of stay of approximately 4 to 5 days in both groups. In addition, Weder and Erickson demonstrated inconsistency in the drug treatment dosing regimens, as the regimens frequently did not follow expert recommendations, with the concomitant risk for ineffective therapy and hypotensive episodes.<sup>16</sup>

It is increasingly clear that multiple factors may impinge on hypertension management in the hospitalized patient. For example, elevated serum uric acid has been shown to be an independent risk factor for hypertension, and it is commonly encountered among hospitalized patients.<sup>17</sup> Hyperuricemia has been shown to blunt the blood pressure response to antihypertensive medications by at least 5 mm Hg.<sup>18</sup> In the same study, the presence of chronic kidney disease and diabetes was shown to blunt blood pressure lowering in men by 8.2 and 6.4 mm Hg, respectively.<sup>18</sup> These patients were shown to require more antihypertensive medications, at baseline, to achieve blood pressure control, and they required more medications during hospitalization, compared to patients with normal serum uric acid levels. These observations reinforce the need for the hospitalist to consider multiple factors in deciding to treat hypertension in the hospitalized patient.

### **Management Of Hypertension In Patients With Congestive Heart Failure**

Patients with congestive heart failure and hypertension represent a population of patients frequently seen by the hospitalist. Specific recommendations for the management of patients with left ventricular

dysfunction (ejection fraction < 40% and more-severe cardiomyopathy) include the use of angiotensin-converting enzyme inhibitor (ACEI) therapy and beta blocker therapy.<sup>19</sup>

Heart failure with preserved ejection fraction (HFpEF) has emerged as a significant proportion of heart failure cases (50%).<sup>20</sup> Management principles and blood pressure goals for HFpEF are concordant with those established for heart failure with reduced ejection fraction, and they involve the use of the same medication strategies: ACEIs/angiotensin II receptor blockers (ARBs), diuretics (chlorthalidone), spironolactone, and the use of a vasodilating beta blockers (carvedilol).<sup>6,20</sup> When managing these patients, hospitalists should ensure that they are using the recommended medications, unless they are specifically contraindicated because of allergy or intolerance of side effects.

### **Initiation Of New Pharmacologic Therapies**

The role of the hospitalist in initiating new pharmacologic therapies in the inpatient setting is not well defined; however, when initiating new therapies, the hospitalist should be guided by the best evidence. A recent meta-analysis examining the use of beta blockers in heart failure and acute myocardial infarction (MI) compared the beta nonselective agent, carvedilol, to the beta<sub>1</sub> selective antagonists (atenolol, metoprolol, bisoprolol, and nebivolol). A significant decrease in all-cause mortality in patients with congestive heart failure (15%) and acute MI (45%) was observed with carvedilol, compared with the beta<sub>1</sub> selective beta blockers. The authors commented on the overuse of atenolol for blood pressure lowering in this population despite the lack of evidence of improved cardiovascular outcomes following acute MI or improved outcomes with congestive heart failure. Moreover, when used for hypertension, despite its effect on lowering blood pressures, atenolol has not proven to protect against heart disease or reduce mortality.<sup>21</sup> The ALLHAT (Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial) demonstrated that a thiazide-type diuretic, calcium-channel blocker, or ACEI/ARB should be the initial drug therapy for most patients with hypertension.<sup>22</sup> This recommendation is carried through in the JNC 8 (Recommendation 6).<sup>6</sup> Chlorthalidone or indapamide are the evidence-based thiazide type diuretics of choice; however, recent studies suggest that hydrochlorothiazide may be as effective, if dosed appropriately.<sup>23</sup> These studies reinforce the need for hospitalists to be aware of differences between medications in the same class and the role of specific medications in the management of hypertension.

## Treatment

An assessment of the patient prior to initiating acute medical management for hypertension is mandated to rule out causes such as pain, anxiety, or volume overload. An evaluation for secondary causes of hypertension may be indicated for refractory hypertension or in the patient with newly diagnosed hypertension.

The medications noted in **Table 3** are the drugs most commonly utilized parenterally for the acute management of episodic hypertension or hypertensive emergencies; however, there is still a lack of data addressing the optimal pharmacologic management of the hospitalized patient with acute hypertension. General considerations to keep in mind when choosing a medication for the treatment of hypertension include:

- Commonly utilized drugs such as labetalol and hydralazine may have significant side effects that limit their titration and prevent achievement of target blood pressure. Hydralazine may induce a reflex tachycardia. In addition, both labetalol and hydralazine demonstrate slow and variable onset of activity. Beta blockers may induce a significant bradycardia and first-degree heart block as well as cause orthostatic hypotension.
- There is a high risk for clinically significant hypotension (with SBP < 90 mm Hg) and risk for end-organ underperfusion, independent of drug choice. The risk for hypotension is 5%, as shown in 1 study.<sup>23</sup>
- Transition to oral medications should be consistent with the most recent JNC 8 guidelines.<sup>6</sup>
- For hypertensive urgencies/emergencies, choose agents that may be administered as a continuous infusion, have a fast onset of activity, have a short-to-intermediate duration, are easy to titrate, and have direct arterial vasodilator effects.<sup>25</sup>

## Special Populations

### Patients With Diabetes

The blood pressure goal in JNC 8 is < 140/90 mm Hg; a SBP goal of < 140 mm Hg is appropriate for most patients with diabetes. Patients with diabetes should be treated to a DBP < 90 mm Hg.<sup>6</sup> (Recommendation 5.)

### Patients With Chronic Kidney Disease

Although the blood pressure goal in the JNC 8 is < 140/90 mm Hg, the AACE Medical Guidelines For Clinical Practice for the Diagnosis and Treatment of Hypertension suggest even tighter control of the blood pressure to ≤ 120/75 mm Hg for patients with significant proteinuria. This recommendation will continue to be controversial.<sup>14</sup> Recent evidence does not demonstrate that the recommended blood pressure target of the JNC 7 (< 130/80 mm Hg) or more aggressive control improves clinical outcomes more than a conventional target of SBP < 140 mm Hg, and this is reflected in the JNC 8.<sup>6,26</sup> (Recommendation 4.)

### Perioperative Patients

The hospitalist will be consulted to assist in the preoperative and postoperative management of the hospitalized surgical patient. No guidelines exist to guide therapeutic interventions; however, the same principles that guide other interventions should be engaged. Hypertension in the acute postoperative setting is well described, is felt to be secondary to catecholamine excess, and, typically, is of short duration.<sup>27</sup> Management of these patients should be aimed at identifying other causes of elevated blood pressure (eg, bladder distention, inadequate pain control, anxiety, acute volume repletion, and hypothermia) before initiating antihypertensive therapy. Drugs of choice are short-acting intravenous medica-

**Table 3. Medications Used In The Management Of Hypertension<sup>24</sup>**

Drug	Class	Onset	Duration	Adverse Effects	Indications/Cautions
Labetalol	BB	10 min	4 h	Hypotension, bradycardia	Hypertensive emergencies, pregnancy
Hydralazine	VD	15 min	2 h	Tachycardia	Pregnancy
Nitroglycerin	VD	5 min	10 min	Hypotension, methemoglobinemia	Myocardial infarction
Nicardipine	VD	10 min	30 min	Tachycardia	Hypertensive emergencies; use caution with myocardial infarction
Enalapril	VD	15 min	8 h	Hypotension; variable response	Avoid in acute myocardial infarction
Sodium nitroprusside	VD	Immediate	2 min	Hypotension, thiocyanate toxicity; may increase ICP	Hypertensive emergencies
Esmolol	BB	2 min	30 min	Hypotension, heart block, heart failure	Aortic dissection, perioperative use
Fenoldopam	VD	2 min	30 min	Tachycardia	Hypertensive emergencies; use caution with glaucoma
Phentolamine	AB	2 min	15 min	Tachycardia	Catecholamine excess

Abbreviations: AB, alpha blocker; BB, beta blocker; ICP, intracranial pressure; VD, vasodilator.



tions that target the sympathetic nervous system (eg, labetalol, esmolol, nicardipine, clevidipine). A more comprehensive review of this topic is beyond the scope of this article, but is well summarized in the paper by Lien and Bisognano.<sup>28</sup> Current evidence no longer supports the routine use of perioperative beta blockers for patients having a non-cardiac surgery;<sup>29,30</sup> however, beta blockers should be continued in patients chronically taking these agents.

### Pregnant Patients

The hospitalist may be consulted to manage hypertension in the setting of a pregnancy. The American College of Obstetricians and Gynecologists recognizes 4 categories of hypertension in the pregnant patient.<sup>31</sup> (See Table 4.)

When managing hypertension in the pregnant patient, pharmacologic decision making must be guided by recognition of the potential risk to the fetus and based on the degree of elevation of the blood pressure. Management with appropriate consultation to subspecialists in maternal-fetal medicine may be required; the comments here are meant to be a general guide. In the nonemergent management of chronic or gestational hypertension, methyldopa (United States Food and Drug Administration [FDA] pregnancy category B) and labetalol have been shown to have equal efficacy. Common drugs used for management of hypertension in pregnancy are shown in Table 5, and drugs to specifically avoid during pregnancy are shown in Table 6.

### Other Populations

Elderly patients represent a large proportion of the patients managed by the hospitalist. Aronow et al summarized the current consensus guidelines for management of hypertension in the elderly.<sup>33</sup> For the general population aged  $\geq 60$  years, the JNC 8 recommends initiating therapy at SBP  $\geq 150$  mm Hg and DBP  $\geq 90$  mm Hg to a goal of SBP  $< 150$  mm Hg, aiming for SBP 140 mm Hg, if tolerated.<sup>6</sup> (Recommendation 1.) The European Society of Cardiology guidelines recommend a goal target of SBP 140 to 150 mm Hg for elderly patients aged  $< 80$  years.<sup>34</sup> This recommendation remains controversial. As a practical measure for hospitalists, one should be

**Table 4. Categories Of Hypertension In The Pregnant Patient**

Chronic hypertension	Blood pressure $\geq 140/90$ mm Hg; presents at $< 20$ weeks' gestation
Chronic hypertension with pre-eclampsia	Blood pressure $\geq 140/90$ mm Hg, with proteinuria; presents at $< 20$ weeks' gestation
Pre-eclampsia/eclampsia	Blood pressure $\geq 140/90$ mm Hg, with proteinuria; presents at $> 20$ weeks' gestation
Gestational hypertension	Blood pressure $\geq 140/90$ mm Hg, no proteinuria; presents at $> 20$ weeks' gestation

cautious in aggressively treating hypertension in the elderly unless they are symptomatic. Table 7 (see page 10) summarizes the recommended treatment strategies for hypertension in some of these special populations.

During sympathetic crises (such as may occur with alcohol withdrawal or the sudden withdrawal of clonidine), acute management centers on the use of beta blocker therapy and, in the case of alcohol withdrawal, clonidine.<sup>38</sup> Finally, drug-induced hypertension is an underrecognized cause of secondary hypertension that may be encountered by the hospitalist.<sup>39</sup>

**Table 5. Antihypertensive Agents To Use In Pregnancy (Blood Pressure  $> 160/110$  mm Hg)**

Drug	FDA Pregnancy Category*	Comments
Hydralazine	C	• First-line therapy, IV bolus
Labetalol	C	• First-line therapy, IV bolus
Nifedipine	C	• Second-line therapy, PO • Risk for acute hypotension
Nitroprusside	C	• Last-line therapy, IV infusion • Dose limited by risk for fetal cyanide toxicity

\*FDA pregnancy categories: A, considered safe; B, no evidence of fetal risk, but human data are lacking; C, limited data, use only if benefit outweighs risk; D, evidence of human fetal risk, medications should only be used in life-threatening situations or where no alternative is available; X, absolutely contraindicated for use in pregnancy.

Abbreviations: FDA, United States Food and Drug Administration; IV, intravenous; PO, by mouth.

**Table 6. Antihypertensive Drugs To Avoid In Pregnancy<sup>32</sup>**

Drug/Class	FDA Pregnancy Category*	Comments
Atenolol	D	• Risk of intrauterine growth restriction
ACEI/ARB	X	• Fetal renal toxicity, • Teratogenic, fetal death
Hydrochlorothiazide	B	• Decreased placental perfusion
Diazoxide	C	• Maternal hypotension
Nimodipine	C	• Maternal hypertension • Risk for pre-eclampsia

\*FDA pregnancy categories: A, considered safe; B, no evidence of fetal risk, but human data are lacking; C, limited data, use only if benefit outweighs risk; D, evidence of human fetal risk, medications should only be used in life-threatening situations or where no alternative is available; X, absolutely contraindicated for use in pregnancy.

Abbreviation: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; FDA, United States Food and Drug Administration.

## Quality Improvement

There are currently no specific guidelines for managing hypertension in the hospitalized patient. Each case must be viewed in the context of the presenting illness. There is room for quality improvement in the following areas:

- For newly defined hypertension in the hospitalized patient, recommended medications should follow the JNC 8 guidelines. The overreliance on the “as needed” use of hydralazine and labetalol may lead to inappropriate overprescribing of these medications for first-line management of newly diagnosed hypertension in the hospitalized patient. Diuretic therapy is the cornerstone of hypertensive management, and ACEIs/ARBs are indicated in diabetic patients and patients with left ventricular dysfunction.
- There is an overdependence on “treating the numbers,” with no clear indication that episodic hypertension in the hospital setting should be managed acutely. Quality improvement studies to examine the impact of “as needed” medications on length of hospital stay, resource utilization with respect to parenteral therapies, and associated adverse events (eg, hypotension and falls) could be useful in the development of quality measures that would be relevant to the practice of hospitalists.
- Currently, the role of the hospitalist in managing prescribed therapies, changing dosing amounts and frequencies, altering medications, and optimizing blood pressure control in the inpatient setting is poorly described in the literature. What is the safe blood pressure for discharge from

the hospital? What is the role of the hospitalist in adjusting medications? Most importantly, how effective are hospitalists at communicating in-hospital events and discharge medications to the primary care physician? Instead of looking at the growing consensus that hospitalists should not “meddle” in chronic disease management, the focus should be shifted to optimizing transitions of care from the inpatient to the outpatient side and putting a premium on important quality measures, including the discharge processes, communication with the primary care physician, and medication reconciliation.<sup>40</sup>

## Additional Considerations

The release of the JNC 8 introduced minor changes to earlier recommendations. Recent evidence from the ACCORD (Action to Control Cardiovascular Risk in Diabetes) trial may change the recommended goals for type 2 diabetics at high risk for cardiovascular events.<sup>41</sup> Intensive antihypertensive therapy in this population did not improve the composite outcome (nonfatal stroke, nonfatal myocardial infarction, and cardiovascular death). Secondary analysis did demonstrate a reduction in total strokes and nonfatal strokes with intensive antihypertensive therapy, but at the expense of increased adverse events. The recent trials to study the recommended blood pressure treatment goals of < 130/80 mm Hg in patients with chronic kidney disease demonstrated a slowing of glomerular filtration rate reduction in patients with significant proteinuria, but not in patients with mild proteinuria.<sup>23</sup> ACEIs/ARBs, calcium-channel blockers, and thiazide-like diuretics

**Table 7. Management Strategies For Selected Special Populations And Supporting Evidence**

Patient Populations	Management	Trial/Report
Black patients	<ul style="list-style-type: none"> <li>• First-line therapy: CCB</li> <li>• First-line therapy: ACEI/ARB + diuretic</li> </ul>	<ul style="list-style-type: none"> <li>• JNC 8<sup>6</sup></li> <li>• ALLHAT<sup>22</sup></li> </ul>
Elderly patients	<ul style="list-style-type: none"> <li>• CCB or ACEI/ARB + diuretic</li> </ul>	<ul style="list-style-type: none"> <li>• ACCF/AHA<sup>20</sup></li> <li>• JNC 8<sup>6</sup></li> </ul>
Pregnant patients	<ul style="list-style-type: none"> <li>• Methyldopa or labetalol: chronic hypertension</li> <li>• Acute elevations: hydralazine</li> </ul>	<ul style="list-style-type: none"> <li>• NHBPEP Report on High Blood Pressure in Pregnancy<sup>31</sup></li> </ul>
Diabetic patients	<ul style="list-style-type: none"> <li>• CCB or ACEI/ARB + diuretic</li> </ul>	<ul style="list-style-type: none"> <li>• UKPDS<sup>35</sup></li> <li>• HOPE<sup>36</sup></li> <li>• JNC 8<sup>86</sup></li> </ul>
Patients with congestive heart failure	<ul style="list-style-type: none"> <li>• ACEI</li> <li>• Beta blocker</li> <li>• Aldosterone antagonist</li> </ul>	<ul style="list-style-type: none"> <li>• COPERNICUS<sup>37</sup></li> <li>• JNC 8<sup>6</sup></li> </ul>

Abbreviations: ACCF, American College of Cardiology Foundation; ACEI, angiotensin-converting enzyme inhibitor; AHA, American Heart Association; ALLHAT, Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial; ARB, angiotensin II receptor blocker; CCB, calcium-channel blocker; COPERNICUS, Carvedilol Prospective Randomized Cumulative Survival Study; JNC 8, 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); NHBPEP, National High Blood Pressure Education Program; UKPDS, United Kingdom Prospective Diabetes Study.

are the preferred first-line agents for management of hypertension.<sup>42,56</sup> Beta blockers are not considered first-line therapy. Atenolol should not be utilized as beta blocker therapy for hypertension.<sup>43</sup>

## Must-Do Markers Of Quality Care

With the widespread adoption of electronic health records and the adoption of meaningful-use measures, hospitalists may be under pressure to report blood pressure management and outcomes for hospitalized patients. Currently, no formal guidelines for the goals of inpatient management of hypertension exist, except as outlined earlier for outpatient management. Inasmuch as care of the hospitalized patient represents a continuum in care from the outpatient to the inpatient setting, adopting the JNC 8 guidelines may be appropriate. However, blood pressure as a quality metric in the inpatient setting is fraught with complications.

The patient stress of hospitalization, coexisting illness, the use of incorrect technique in obtaining blood pressures, and the effects of medications introduced in the hospital setting may all lead to misclassification of patients as hypertensive or to mismanagement of patients based on a single measurement of the blood pressure. Guideline development for hospitalized patients should focus on appropriate technique, with recommendations on when and where blood pressures should be measured and how many measurements need to be averaged to guide treatment decisions.<sup>44</sup> In a notable study from Germany, intensive management of patients with hypertension and left ventricular hypertrophy in the hospital setting achieved a 68% rate of blood pressure control compared to a 45% rate of control in outpatients.<sup>45</sup> There was no analysis of the data, but it does suggest a potential role for aggressive optimization of blood pressure in the inpatient setting and collaborative efforts between hospitalists and outpatient physicians to achieve optimum blood pressure control. In addition, there may be a role for immediate, postdischarge, hospitalist-run outpatient clinics to ensure adherence to prescribed therapies and to optimize outcomes.<sup>46</sup> Identification of new hypertension may be aided by the use of 24-hour ambulatory blood pressure monitoring during an acute hospitalization.<sup>47</sup>

## Disposition And Transitions Of Care

The hospitalist has a role in the identification of new hypertension in the hospitalized patient and optimization of blood pressure management in patients with pre-existing hypertension. The frequent use of as-needed dosing of hydralazine and labetalol for episodic hypertension during an acute hospitalization may lead to these patients being discharged

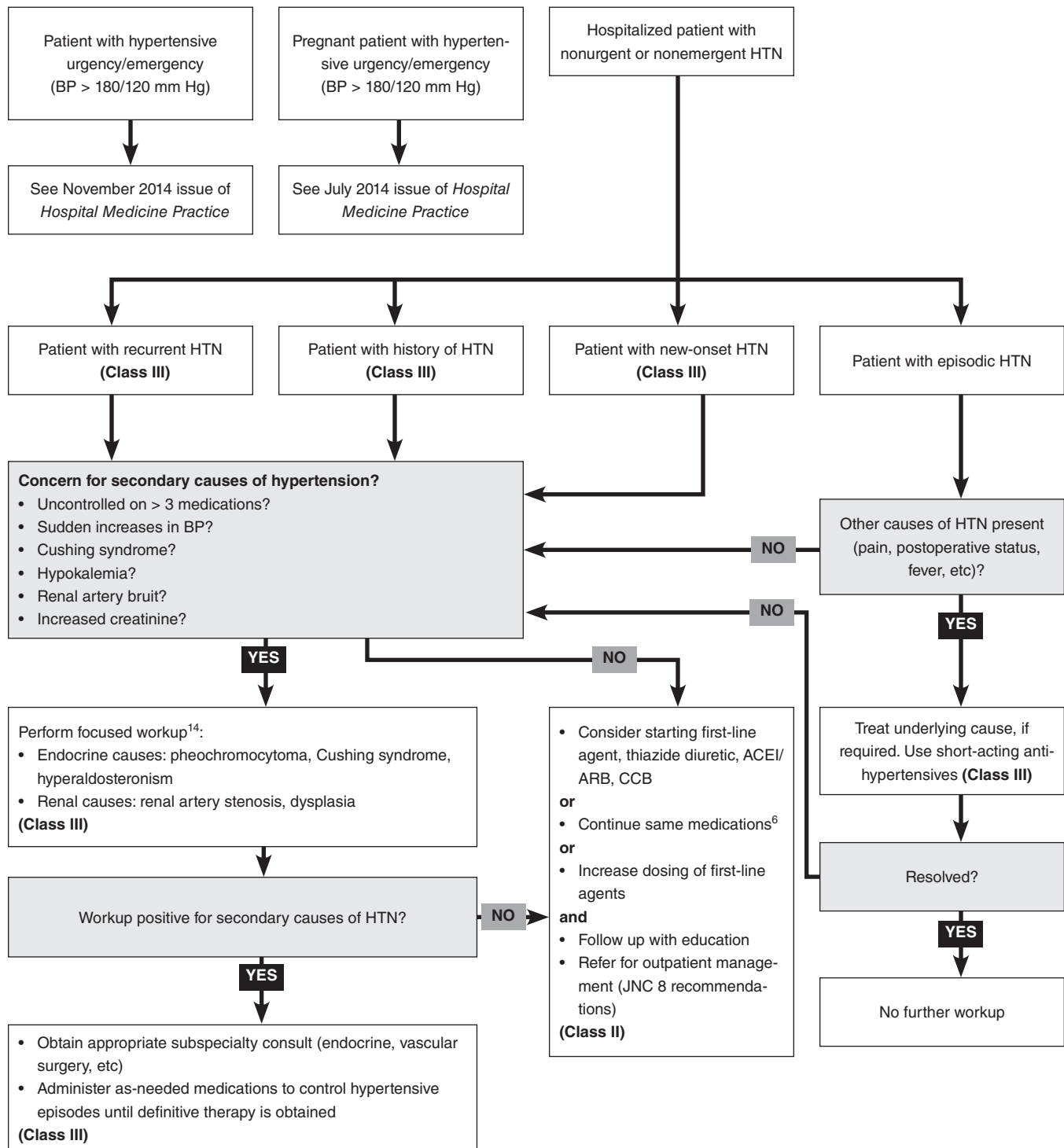
with a prescription for either of these medications for hypertension. Neither of these agents is considered first-line therapies, and they both require more than once-daily dosing, a known risk factor for nonadherence. Hospitalists should be aware of the specific discharge recommendations when prescribing medications at discharge.

Medications for hypertension are frequently not administered (or "held") during an acute hospitalization due to hypotensive episodes, acute stroke, acute kidney injury, or for myriad other reasons. There are no absolute guidelines for the timing of the reintroduction of antihypertensive medications that were held at admission. Frequently, patients will be advised to resume all home medications at discharge. A reasonable strategy is to introduce (or reintroduce) medications prior to discharge to ensure that they are tolerated. When new medications are introduced or existing medications are changed (with respect to dosing and frequencies), it is imperative that the discharging physician communicates these changes to the primary care provider, provides a written summary of the changes for the patient, updates existing medication lists, and provides a copy to the primary care provider's office within 48 hours of discharge. Close follow-up with the primary care provider within 7 days should be ensured.

Patient nonadherence with newly prescribed medications is a significant concern that is associated with increased readmission rates and substantial associated healthcare costs. The hospitalist has a significant role in managing the patient with new or changed medications at discharge to prevent adverse medication events associated with nonadherence following discharge. It has been estimated that 20% of patients discharged from the hospital will experience an adverse drug-related event at discharge and that 60% of these events will be associated with nonadherence.<sup>48</sup> Other studies have estimated that 35% to 70% of hospital admissions related to adverse medication events are associated with medication nonadherence, with an associated healthcare cost of \$100 to \$200 billion annually.<sup>49-52</sup> The hospitalist is intimately involved with the process of transition from the hospital to the outpatient setting.<sup>53</sup> New payment rules associated with the Affordable Care Act will directly affect hospitalists through nonpayment for readmissions, and it will be incumbent upon the hospitalist to recognize the extent of this problem and to adopt strategies to mitigate against it. Several strategies that can be adopted by the hospitalist, at discharge, to reduce the risk of nonadherence and subsequent medication-associated readmissions include the following:

- Close communication with the patient's primary care physician.
- Use of once-daily dosed medications.

# Clinical Pathway For Management Of Nonemergent Hypertension In The Nonpregnant Patient



Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; BP, blood pressure; CCB, calcium-channel blocker; HTN, hypertension; JNC 8, 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults. For class of evidence definitions, see page 13.

- Teach-back methods with patients regarding their medications and the indications for use.
- Development of multidisciplinary teams incorporating pharmacists.
- Follow-up phone calls or direct visits to the patient's home following discharge.
- Creation of hospitalist-run follow-up outpatient clinics.

It is outside the scope of this review to address in detail the literature surrounding this topic area, but a good review is offered by Osterberg and Blaschke.<sup>54</sup>

## Summary

Hospitalists are frequently engaged in the management of patients with hypertension at all levels of acuity. The prevalence of hypertension and its associated cardiovascular risk factors is estimated to be as high as 50% in hospitalized patients. Hospitalists have a role in the initial identification of hypertension and the optimal treatment of existing hypertension. Management strategies in hypertension should be based on clinical guidelines (JNC 8), where available, and best evidence. Hospitalists should be aware of the recommended medications available for the management of hypertensive emergencies, acute ischemic or hemorrhagic stroke, the pregnant patient, and in patients with heart failure. Currently, no specific guidelines exist for the management of hypertension in the hospitalized patient except for these emergent and compelling situations. Introduction of new medications and adjustments to existing medications should be guided by best-practice considerations (JNC 8, SOLVD [Studies of Left Ventricular Dysfunction], ALLHAT, ACCORD). The hospitalist has an obligation to remain current with existing guidelines and ongoing clinical trials.

## Case Conclusion

Your 45-year-old HIV-positive patient was thought to have influenza-like illness, which resolved over the subsequent 3 days he was hospitalized. He remained hypertensive throughout his hospitalization. You obtained a renal artery duplex, and he did not demonstrate stenotic disease. Urine analysis did demonstrate proteinuria; the creatinine was elevated at 1.6 mg/dL. You concluded that the patient had HIV-associated nephropathy, so you restarted his antiretroviral therapy according to his previous regimen. The patient continued to display hypertension, ultimately requiring 4 drugs at discharge to maintain his SBP < 160 mm Hg. You discharged him home on first-line therapies, including ACEI therapy, diuretic therapy, calcium-channel blocker therapy (amlodipine), and clonidine via a transdermal patch. You scheduled follow-up with his primary care physician within 7 days of discharge for repeat blood pressure check and further optimization of his medication regimen.

## Time- And Cost-Effective Strategies

It is clear that the treatment of episodic hypertension in the hospital leads to increased lengths of stay and added cost. It is also clear that, in some instances, initiation of antihypertensive therapies in the hospital setting leads to better postdischarge outcomes, as measured by the continuation of therapies at follow-up. It seems reasonable that hospitalists should initiate therapy for newly diagnosed hypertension following the recommendations offered in the JNC 8, and they must ensure close follow-up in the outpatient setting. The role of treatment of episodic hypertension with parenteral therapies is unresolved, but based on the available literature, it seems unwarranted in the absence of true hypertensive emergency.

## Class Of Evidence Definitions

Each action in the clinical pathways section of *Hospital 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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## 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.

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## Charting & Reimbursement: What You Need To Know

In discussing essential and secondary HTN documentation, changes under ICD-10 and issues surrounding the treatment of hypertension should be reviewed. HTN codes under ICD-10 are simplified, compared to ICD-9. There are a total of 9 codes: 4 primary and 5 secondary.

### Primary Hypertension

- **I10 essential (primary) HTN:** includes "benign," "malignant," urgency. This code excludes patients with comorbid heart or renal disease.
- **I11 HTN heart disease:** cardiac dysfunction related to HTN; eg, HTN + systolic heart failure
- **I12 HTN chronic kidney disease:** HTN and CKD are both present
- **I13 hypertensive heart disease and chronic kidney disease.** A patient meets criteria for both I11 and I12.

The terms "benign" and "malignant" are dropped. This is a nod to HTN's role as a major cause of mortality/morbidity (which is not so benign). Writing "high blood pressure" will code, but not "elevated blood pressure."

Code I10 is the default code if the HTN is: (a) not further specified and, (b) doesn't have an assumed link, such as in CKD. All commonly used terminology (such as benign, essential, malignant, emergency, etc) falls under the same category.

You could argue that this allows us to say pretty much whatever we want and just use the word "hypertension." But remember: we're not only trying to code correctly, we're telling the patient's story. Auditors and your peers will understand better why a patient with malignant HTN is in the intensive care unit, someone with accelerated HTN is inpatient, and the benign HTN patient can be discharged home. HTN is an extremely common outpatient condition; therefore, extra effort needs to be made to describe why a particular individual needs hospitalization for blood pressure issues.

### Secondary Hypertension

Secondary HTN is not a stand-alone code, it must be further defined with the cause (even if the cause is "unspecified").

- **I15 renovascular HTN:** renal artery stenosis
- **I15.1 HTN due to other renal disorders**
- **I15.2 HTN due to endocrine disorders:** pheochromocytoma
- **I15.8 other secondary HTN:** erythropoietin-induced HTN

- **I15.9 secondary HTN, unspecified:** when there is known or probable secondary HTN, draw a link between the two (eg, "hypertension secondary to Cushing syndrome"). Don't forget that medication-induced hypertension is considered a secondary cause.

### Other ICD-10 Codes For Hypertension-Related Issues

- **I97.3 postprocedural HTN**
- **I67.4 hypertensive encephalopathy**

### Other Documentation Issues

- We often forget to note when there are complications of treatment. Remember to get credit for those late-night calls for hypotension or bradycardia that are due to the medications. Capture the relationship between medications and end-organ dysfunction, such as ACEI-induced renal failure, clonidine-induced hypotension, and beta blocker-induced bradycardia.
- **Z91.19 noncompliance.** ICD-10 recognizes that the noncompliant patient (regardless of the cause) is more difficult to treat and is at higher risk for complications. State the how and why of noncompliance. Some examples include dietary, dialysis, medication, or unintentional due to financial hardship.

### Pearls

- Keep it simple. Note if the HTN is due to another disease/issue (secondary) and link it. Note if there is heart disease and link to the HTN (if appropriate). Note if there is CKD. Otherwise, use the label you think is appropriate (eg, emergency).
- Capture complications (even temporary) of HTN treatment. Link the cause (eg, beta blocker) with the effect (eg, bradycardia)
- Do not state "elevated blood pressure," as this is not a recognizable diagnosis.
- Document whether the patient is noncompliant and how he is noncompliant.
- For inpatients, always include: (1) your intent for inpatient care, (2) why the patient needs hospitalization, (3) what the risks are for outpatient treatment, (4) how long they will stay, and (5) what the possible/probable posthospital disposition will be.

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; CKD, chronic kidney disease; HTN, hypertension; ICD, International Classification of Diseases.

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## Risk Management Pitfalls For Nonemergent Hypertension Management (Continued on page 17)

1. **"I always write an as-needed order for SBP > 160 mm Hg."**  
There is no evidence to support treating isolated, episodic, and asymptomatic hypertension. The patient should be evaluated for symptoms (eg, hypertensive emergency) and appropriate medications should be instituted, following the guidelines (JNC 8) for first-line medications.
2. **"I only discharge patients from the hospital when their SBP is < 160 mm Hg."**  
There are no published guidelines that indicate a target blood pressure for safe discharge from the hospital. The management of stage 2 hypertension in the JNC 8 guidelines recommends outpatient management with close clinic follow-up. The asymptomatic hypertensive patient can be discharged with close follow-up in the outpatient setting.
3. **"I always wait at least 24 hours after initiating a new antihypertensive agent in the hospital before I discharge the patient."**  
A 24-hour observation period after the introduction of new antihypertensives or after resuming home medications appears to be a common strategy, but is not supported by current guidelines or evidence. Ensuring close outpatient follow-up correlates with better long-term outcomes rather than a prolonged stay in the hospital setting.
4. **"The antihypertensive medications I ordered are not working. The patient continues to have episodes of uncontrolled hypertension and is requiring escalating doses of antihypertensive medication."**  
When confronted with refractory hypertension, the hospitalist must consider secondary causes. These conditions represent < 5% of causes of hypertension, but they are frequently resistant to therapy, represent renovascular disease, or have an endocrinological etiology.
5. **"I have diagnosed new-onset hypertension in my hospitalized patient, as she was requiring multiple as-needed intravenous doses of hydralazine for intermittent blood pressure readings with SBP > 160 mm Hg."**  
Hydralazine is a commonly utilized medication for the management of episodic hypertension in the hospitalized patient, but hydralazine is not considered first-line therapy for hypertension. Many factors can impinge on blood pressure readings in the hospitalized patient, including metabolic derangement as hyperuricemia, stress, and pain. A new diagnosis of hypertension must be confirmed by appropriate blood pressure measurements in the relaxed, well patient.



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## Risk Management Pitfalls For Nonemergent Hypertension Management (Continued from page 16)

6. **"I use intravenous beta blockers for the as-needed management of hypertensive episodes in the hospitalized pregnant patient."**  
Beta-blocker therapy is not considered first-line management for hypertension by the JNC 8 or by the American College of Obstetricians and Gynecologists. While labetalol has a defined role in the management of acute hypertensive crises, in the hospitalized pregnant patient, this does not generalize across all beta blockers.
7. **"I have discharged my patient with a new prescription for an antihypertensive; my job is done."**  
Recognize that the hospitalist is a crucial partner in ensuring the safety of the patient at discharge and in the continuum of care. Timely communication with the primary care provider regarding medication changes has been shown to correlate with better outcomes for patients, and medications introduced in the hospital with close outpatient follow-up result in better long-term blood pressure control.
8. **"Patients with chronic kidney disease and diabetes require blood pressure lowering to SBP < 130 mm Hg."**  
The JNC 8 has now raised the recommended targets for patients with chronic kidney disease and diabetes to 140/90 mm Hg; the older values reported in the JNC 7 are no longer recommended as targets. This area will continue to be controversial.

9. **"My postoperative patient on the surgical service is demonstrating hypertensive episodes, which I need to treat with long-acting antihypertensives."**  
Recognize that hypertension in the acute postoperative state is common and reflects catecholamine excess. This response appears to be protective, and long-acting medications should be avoided. If it is necessary to treat hypertension in the postoperative setting, the drug(s) of choice are short-acting medications that target the autonomic nervous system. Associated causes of elevated blood pressure should be identified (bladder distention, pain, etc).
10. **"My elderly patient, aged > 60 years, appears to have hypertension, with a SBP of 145 mm Hg, and I am going to recommend discharge with an antihypertensive."**  
Recognize that the JNC 8 guidelines now accept a SBP of  $\geq 150$  mm Hg for the initiation of antihypertensive therapy in the patients aged  $\geq 60$ . These older patients may be extremely sensitive, and aggressively treating them with antihypertensive may result in hypotensive episodes with a risk for falls, self-injury, and a blunted consciousness. Deferring management of these patients to the outpatient physician instead of discharging them home with a new prescription for antihypertensives would seem to be advised.

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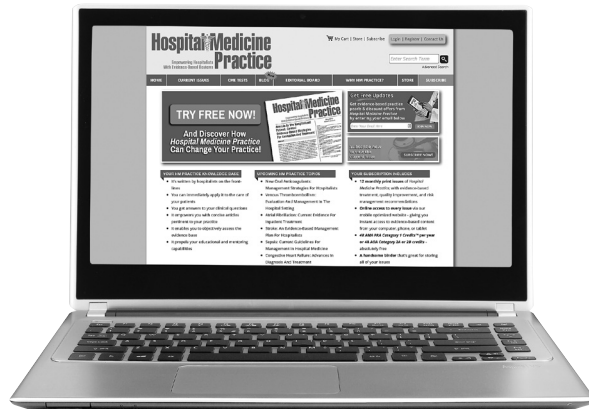
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- The JNC 8 guidelines specifically address the management of hospitalized patients.**
  - True
  - False
- Hospitalists are likely to identify new, undiagnosed hypertension in what percentage of hospitalized patients?**
  - 5%
  - 10%
  - 30%
  - 45%
- Secondary causes of hypertension should be considered in the case of:**
  - A patient who presents with difficult-to-control hypertension at age 25 years
  - A patient who has been on 4 agents for blood pressure control and remains hypertensive
  - A patient presenting with hypertension, hypokalemia, and metabolic alkalosis
  - A patient with an elevated creatinine and an abdominal bruit
  - All the above are consistent with possible secondary causes of hypertension.
- Management of acute episodic hypertension with intravenous antihypertensive agents in the hospitalized patient has been shown to:**
  - Decrease the length of the hospital stay
  - Increase the length of the hospital stay
  - Decrease the overall cost of the hospital stay
  - Be linked clearly to overall improvement in mortality statistics
- For patients with diabetes or chronic kidney disease, the JNC 8 guidelines recommend a target blood pressure of:**
  - < 120/75 mm Hg
  - < 130/80 mm Hg
  - < 140/90 mm Hg
  - < 160/100 mm Hg
- You are caring for a patient who was admitted for flu-like symptoms with mild hypoxemia (now resolved), and you are considering discharge. She has evidence of stage 1 kidney disease. Daily blood pressures have ranged from 150-170 mm Hg/60-90 mm Hg. Today, the blood pressure is 160/95 mm Hg. Based on your understanding of the JNC 8 guidelines and other clinical trials, which of the following do you recommend?**
  - Hold the discharge, start intravenous labetalol, and titrate the blood pressure to < 140/90 mm Hg.
  - Prescribe ACEI therapy and discharge the patient.
  - Prescribe a combination therapy of a thiazide diuretic and an ACEI; discharge and arrange follow-up within 1 week.
  - Prescribe monotherapy with a calcium-channel blocker and discharge the patient.
- Management of hypertensive episodes in the postoperative setting is best done with:**
  - Short-acting agents that target the sympathetic nervous system
  - Long-acting medications without intrinsic sympathetic effect
  - No acute intervention is indicated
- The initial medication of choice for treatment of newly diagnosed hypertension without evidence of renal or cardiac disease is:**
  - Thiazide-type diuretic
  - Beta nonselective agent
  - Beta<sub>1</sub> selective agent
  - Hydralazine
  - Labetalol

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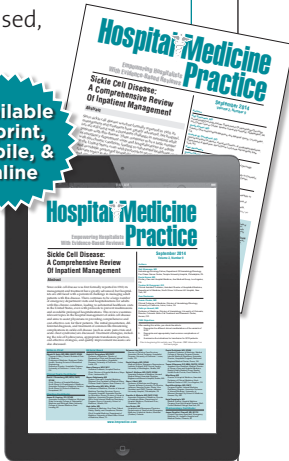
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