

Health Care Guideline

Hypertension Diagnosis and Treatment

The November 2014, Fifteenth Edition of ICSI's Hypertension Diagnosis and Treatment Health Care Guideline incorporates a revision of our previous diagnosis content (2012) as well as an endorsement of 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).

To access the endorsed Treatment content, [click here](#).

To access the endorsed 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) content, [click here](#).

How to cite this document:

Kenning I, Kerandi H, Luehr D, Margolis K, O'Connor P, Pereira C, Schlichte A, Woolley T. Institute for Clinical Systems Improvement. [Hypertension Diagnosis and Treatment](#). Updated November 2014.

Copies of this ICSI Health Care Guideline may be distributed by any organization to the organization's employees but, except as provided below, may not be distributed outside of the organization without the prior written consent of the Institute for Clinical Systems Improvement, Inc. If the organization is a legally constituted medical group, the ICSI Health Care Guideline may be used by the medical group in any of the following ways:

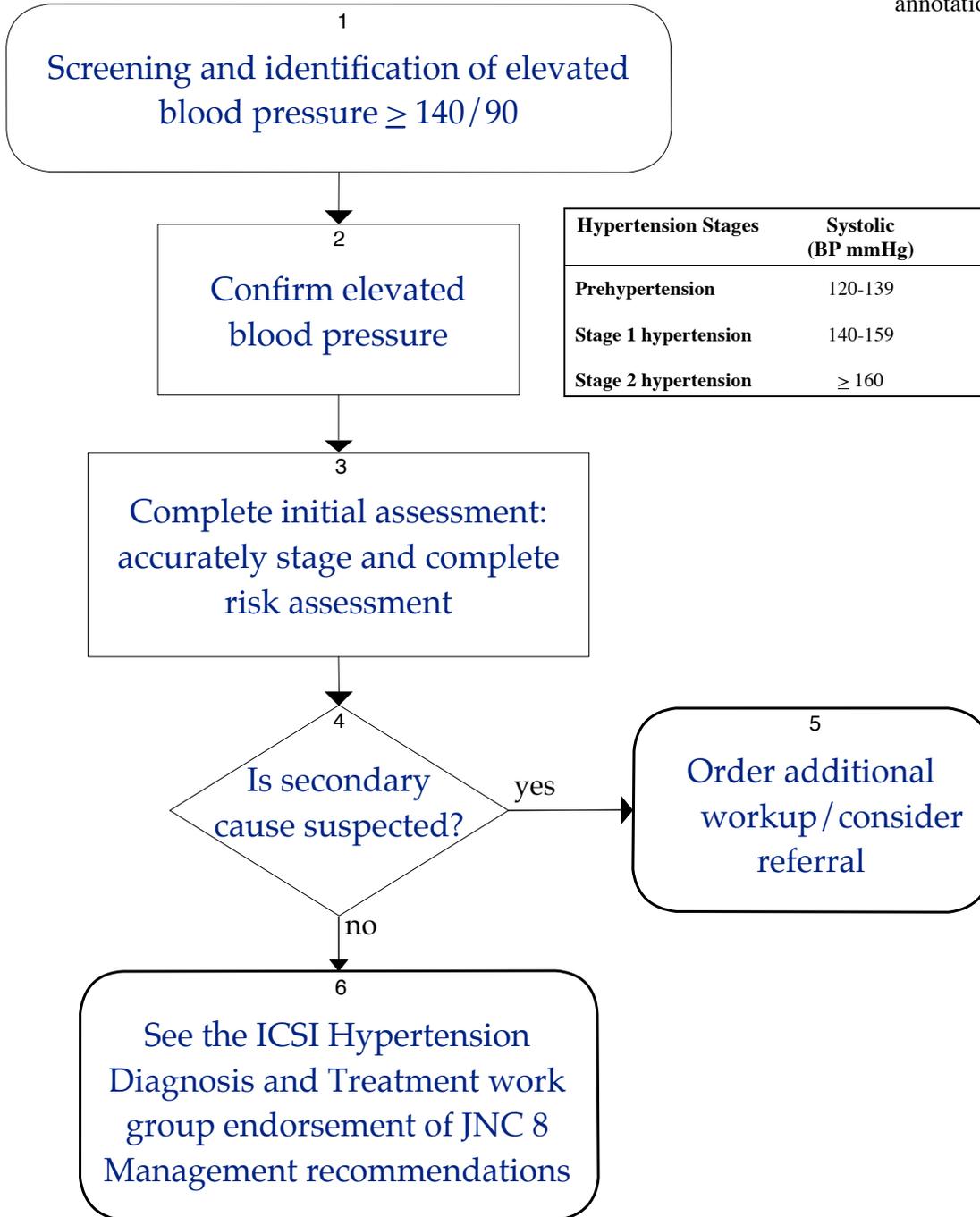
- copies may be provided to anyone involved in the medical group's process for developing and implementing clinical guidelines;
- the ICSI Health Care Guideline may be adopted or adapted for use within the medical group only, provided that ICSI receives appropriate attribution on all written or electronic documents and
- copies may be provided to patients and the clinicians who manage their care, if the ICSI Health Care Guideline is incorporated into the medical group's clinical guideline program.

All other copyright rights in this ICSI Health Care Guideline are reserved by the Institute for Clinical Systems Improvement. The Institute for Clinical Systems Improvement assumes no liability for any adaptations or revisions or modifications made to this ICSI Health Care Guideline.

**Fifteenth Edition
November 2014**

Diagnosis Algorithm

Text in blue in this algorithm indicates a linked corresponding annotation.



Evidence Grading

Literature Search

A consistent and defined process is used for literature search and review for the development and revision of ICSI guidelines.

GRADE Methodology

Following a review of several evidence rating and recommendation writing systems, ICSI has made a decision to transition to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system.

GRADE has advantages over other systems including the current system used by ICSI. Advantages include:

- developed by a widely representative group of international guideline developers;
- explicit and comprehensive criteria for downgrading and upgrading quality of evidence ratings;
- clear separation between quality of evidence and strength of recommendations that includes a transparent process of moving from evidence evaluation to recommendations;
- clear, pragmatic interpretations of strong versus weak recommendations for clinicians, patients and policy-makers;
- explicit acknowledgement of values and preferences; and
- explicit evaluation of the importance of outcomes of alternative management strategies.

(This document is in transition to the GRADE methodology)

Foreword

Related ICSI Scientific Documents

Guidelines

- [Diagnosis and Initial Treatment of Ischemic Stroke](#)
- [Diagnosis and Management of Type 2 Diabetes Mellitus in Adults](#)
- [Healthy Lifestyles](#)
- [Heart Failure in Adults](#)
- [Lipid Management in Adults](#)
- [Prevention and Management of Obesity for Adults](#)
- [Preventive Services for Adults](#)
- [Stable Coronary Artery Disease](#)

Definition

Clinicians – All health care professionals whose practice is based on interaction with and/or treatment of a patient.

Algorithm Annotations

1. Screening and Identification of Elevated Blood Pressure Greater Than or Equal to 140/90

The entry point to this guideline is through the ICSI [Preventive Services for Adults](#) guideline. Patients should receive routine blood pressure screening and identification of elevated blood pressure in the manner recommended in that guideline.

[Return to Algorithm](#)

2. Confirm Elevated Blood Pressure

Recommendations:

- A standardized blood pressure measurement process is important for correctly classifying blood pressure.
- Elevated blood pressure readings should be confirmed.
- Self-monitoring of blood pressure should be encouraged in patients with elevated blood pressure.

Accurate, reproducible blood pressure measurement is important to allow comparisons between blood pressure values and to correctly classify blood pressure (*Pickering, 2005 [Guideline]*). Incorrectly classifying a hypertensive patient as normotensive fails to identify their increased risk for vascular events and kidney disease. Incorrectly classifying a patient with normal blood pressure as hypertensive can result in unnecessary worry, time costs, medical costs and exposure to treatment-related harm.

In the health care setting, blood pressure may be measured manually using the auscultatory technique with a sphygmomanometer and stethoscope. Mercury sphygmomanometers are no longer permitted in health care settings. Anaeroid sphygmomanometers use a lever and bellows system in place of the mercury column but must be calibrated regularly to maintain accuracy. "Hybrid" sphygmomanometers use an electronic pressure gauge, but blood pressure is still determined by auscultation (*Ogedegbe, 2010 [Reference]*).

Oscillometric sphygmomanometers use a pressure transducer to determine the mean arterial pressure in the upper arm at the brachial artery. Systolic and diastolic blood pressure are then calculated based on an algorithm. Devices that measure blood pressure at alternative sites like the wrist or finger are not sufficiently accurate and are not recommended. Blood pressure measured using a standardized technique with a validated oscillometric device can be used instead of manual auscultation and may reduce white-coat effect and other errors (*Myers, 2011 [High Quality Evidence]; Myers, 2010 [Low Quality Evidence]*). Some oscillometric devices can be automated to measure blood pressure multiple times at varying intervals and may also be programmed to incorporate a waiting period before the first measurement. Less expensive devices meant for home use are widely available, but many have not been independently validated for accuracy against a reference standard. A list of devices and results of validation testing can be found at <http://www.dableducational.org>.

Blood pressure may vary substantially and is affected by emotions, pain, eating, voiding, caffeine, nicotine, drugs, body position, mental activity and physical activity. Therefore, if an elevated blood pressure reading has been obtained, the blood pressure level should be confirmed on a different day. Confirmation may be based on 1) one or more follow-up visits with at least two blood pressure readings at each visit, 2) 24-hour ambulatory blood pressure monitoring or 3) home blood pressure monitoring using a validated device.

[Return to Algorithm](#)

Confirmation of elevated blood pressure using repeated office blood pressure measurement alone is common in current clinical practice. Repeating office blood pressure measurement is subject to the following limitations compared with out-of-office methods: 1) lower diagnostic accuracy (*Hodgkinson, 2011 [Systematic Review]*), 2) lower prognostic value for predicting future cardiovascular events (*National Clinical Guideline Centre [UK], 2011 [Guideline]*) and 3) failure to capture blood pressure variations over time. One explanation for lower diagnostic and predictive value is that 15-30% of individuals have higher blood pressure in the medical setting and in the presence of medical personnel, a phenomenon named the white-coat effect or isolated clinic hypertension (*McManus, 2012 [Guideline]*).

A second method of confirming elevated blood pressure that is gaining increasing acceptance is ambulatory blood pressure measurement (ABPM). ABPM devices are small, portable machines connected to a blood pressure cuff worn by patients. ABPM devices record blood pressure using oscillometry at regular intervals while patients go about their normal activities including sleep. Measurements are typically taken at 20-to-30-minute intervals over 24 to 48 hours. Results may be reported for 24 hours, day (awake) and night (sleep) (*Ogedegbe, 2010 [Reference]*). As noted above, ABPM has better diagnostic accuracy (*Hodgkinson, 2011 [Systematic Review]*) and predicts subsequent cardiovascular events and target organ damage more reliably than office blood pressure measurements (*National Clinical Guideline Centre [UK], 2011 [Guideline]*). Limitations of ABPM include cost, availability, discomfort and sleep disturbance.

A third method of confirming elevated blood pressure is home blood pressure monitoring (HBPM) with an automated oscillometric device that records pressure from the brachial artery. Although the evidence is less extensive than for ABPM, HBPM identifies patients with normal out-of-office blood pressure readings, and home readings are a stronger predictor of subsequent cardiovascular events than are office readings.

(*Fagard, 2005 [Meta-analysis]*; *Ohkubo, 1998 [Low Quality Evidence]*; *Niiranen, 2010 [Low Quality Evidence]*; *Asayama, 2006 [Low Quality Evidence]*)

Self-monitoring may improve adherence to treatment and has been associated with small improvements in BP control, even in the absence of additional self-management support interventions (*Uhlig, 2013 [Systematic Review]*).

For patients with non-hypertensive levels of blood pressure upon initial screening or confirmatory testing, re-screening should occur at intervals based on the risk for incident hypertension. Incident hypertension increases markedly with age, blood pressure level and body mass index, and is highest in African Americans. Depending on a number of risk factors, re-screening at one- to two-year intervals is recommended. In non-African American individuals ages 18-40 with normal BMI (< 25 kg/m²) and normal blood pressure (< 120/80 mmHg), even less frequent re-screening can be considered due to the low risk of incident hypertension.

[Return to Algorithm](#)

3. Complete Initial Assessment: Accurately Stage and Complete Risk Assessment

Recommendations:

- It is important to accurately stage newly confirmed hypertension and assess risk for cardiovascular disease and other target organ damage.
- A complete review of all medications (prescription and over-the-counter) is very important.

[Return to Algorithm](#)

Algorithm Annotations

The goal of the clinical evaluation in newly confirmed hypertension is to determine whether the patient has primary or secondary hypertension, target organ damage, and other cardiovascular risk factors.

The absolute risk of cardiovascular events or other complications of hypertension increases progressively with the level of blood pressure, the number of non-hypertensive cardiovascular risk factors, and the severity and extent of target organ damage. Using the 2013 ACC/AHA Pooled Cardiovascular Risk Equation, a 10-year coronary heart disease risk level can be estimated for an individual based on age, sex, race, total and high-density lipoprotein-cholesterol levels, systolic blood pressure level, smoking status, diabetes status and whether the individual uses antihypertensive medications (*Goff, 2013 [Low Quality Evidence]*). This method of risk assessment makes clear the need not only to control blood pressure but also to control all cardiovascular risk factors to maximize risk reduction.

Specific approaches to the diagnosis and management of dyslipidemia are reviewed in the ICSI Lipid Management in Adults guideline.

- **Accurately Stage Hypertension**

This treatment guideline is designed to be used in new or previously diagnosed hypertensive patients in conjunction with the ICSI [Preventive Services for Adults](#) guideline.

Hypertension Stages	Systolic (BP mmHg)		Diastolic (BP mmHg)
Prehypertension	120-139	or	80-89
Stage 1 hypertension	140-159	or	90-99
Stage 2 hypertension	≥ 160	or	≥ 100

Modified from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52.

When systolic and diastolic pressure falls into different categories, the higher category should be selected in classifying the individual's blood pressure status.

- **Medical History**

The history should focus on modifiable lifestyle factors including weight change, dietary intake of sodium and cholesterol, level of physical activity, psychosocial stressors and patterns of alcohol, recreational drug and tobacco use.

Determine all medications being used – including herbal supplements, over-the-counter, prescription and recreational drugs – as many agents may temporarily elevate blood pressure and/or adversely affect blood pressure control (*Aw, 2005 [Meta-analysis]; Priya, 2000 [Low Quality Evidence]*).

Determine if there is a family history of hypertension, cardiovascular disease, cerebrovascular disease, diabetes mellitus and dyslipidemia in first- or second-degree relatives, and document if there is.

Assess for symptoms and signs of target organ damage and secondary hypertension via a directed history and focused examination.

- **Physical examination**

The initial physical examination should include the following in order to accurately stage hypertension, assess target organ damage and search for signs of secondary causes of hypertension:

- Two or more blood pressure measurements separated by at least one minute with the patient seated with back supported, feet flat on the floor and upper arm supported at the level of the mid-sternum.

[Return to Algorithm](#)

www.icsi.org

Algorithm Annotations

- Measurement of height, weight and calculation of body mass index.
 - Funduscopic examination for hypertensive retinopathy (i.e., arteriolar narrowing, focal arteriolar constrictions, arteriovenous crossing changes, hemorrhages and exudates, disc edema). While the reproducibility of office funduscopic findings is poor, there are clinical findings (in particular, retinal hemorrhages, papilledema) that guide important clinical decisions.
 - Examination of the neck for distended veins or an enlarged thyroid gland
 - Examination of the heart for abnormalities in rate and rhythm, increased size, precordial heave, clicks, murmurs, and third and fourth heart sounds
 - Examination of the lungs for rales and evidence of bronchospasm
 - Examination of the abdomen for renal or abdominal aortic bruits, enlarged kidneys, masses and abnormal aortic pulsation
 - Examination of the extremities for diminished or absent peripheral arterial pulsations, bruits and edema
 - Neurological assessment
- **Initial laboratory studies**

Initial lab screen should include 12-lead electrocardiogram, urinalysis, fasting blood glucose or A1c, serum sodium, potassium, creatinine (with estimated or measured glomerular filtration rate), calcium and lipid profile (total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglycerides). Additional laboratory and diagnostic studies may be required in individuals with suspected secondary hypertension and/or evidence of target organ damage. Other tests may be ordered at the discretion of the clinician such as complete blood count, chest x-ray, uric acid or TSH (*Chobanian, 2003 [Guideline]*).

Cardiovascular Risk Factors/Target Organ Damage as Supported by Latest Evidence

Major risk factors

- Hypertension
- Elevated LDL cholesterol
- Family history of premature cardiovascular disease (men younger than 55 or women younger than 65)
- Physical inactivity
- Tobacco usage, particularly cigarettes

Target organ damage

- Heart
 - Left ventricular hypertrophy
 - Angina/prior myocardial infarction
 - Prior coronary revascularization
 - Heart failure
- Brain
 - Stroke or transient ischemic attack
 - Dementia
- Chronic kidney disease
 - Estimated GFR less than 60 mL/min
 - Microalbuminuria
- Peripheral arterial disease
- Retinopathy

[Return to Algorithm](#)

4. Is Secondary Cause Suspected?

Secondary causes account for only a small percentage of all cases of hypertension, but their detection can be important to determine appropriate intervention. Some lifestyle risk factors like obesity and excessive alcohol use may also contribute to hypertension and treatment resistance but are not usually classified as secondary causes.

Features suggestive of secondary hypertension include abrupt onset of symptomatic hypertension, hypertensive crisis, sudden loss of blood pressure control after previous stability on drug therapy and drug resistance hypertension.

Differential diagnosis and typical approach to evaluations are shown below.

Diagnosis	Signs/Symptoms	Options for Further Evaluation
Chronic kidney disease	Variable, may be absent	Estimated GFR, urinalysis
Renalvascular hypertension	Unexplained hypertension in younger women, abdominal bruit	Consult with specialist
Sleep apnea	Excessive daytime sleepiness, obesity, snoring	History, sleep study
Primary aldosteronism	Unprovoked hypokalemia	Plasma renin/aldosterone ratio 24-hour urine aldosterone
Drug-induced (prescription, over-the-counter, supplements or illicit drugs)	Variable history	Medication review, urine toxin screen
Aortic coarctation	Unequal blood pressure in right and left arms, delayed or absent femoral pulses	Aortic imaging, consult local experts for preferred test
Cushing syndrome	Hyperglycemia, truncal obesity	Dexamethasone suppression test, 24-hour urine free cortisol
Pheochromocytoma	Paroxysmal symptoms	24-hour urine metanephrines and normetanephrines, plasma-free metanephrines
Thyroid/parathyroid disease	Variable, hypercalcemia	TSH, serum PTH

Care should be taken to ensure advanced testing is correctly chosen and done properly to avert the need for repeat studies. This may require discussion with or referral to a specialist.

[Return to Algorithm](#)

5. Order Additional Workup/Consider Referral

If screening tests for secondary hypertension are positive, consider appropriate referral for additional workup and treatment.

If you suspect a diagnosis of secondary hypertension, it is recommended that you obtain a consultation early in order to confirm the most efficient and cost-effective approach to patient evaluation and management (*Chobanian, 2003 [Guideline]; Gifford Jr, 1989 [Guideline]*).

Return to Algorithm

6. See the ICSI Hypertension Diagnosis and Treatment Work Group Endorsement of JNC 8 Management Recommendations

Return to Algorithm