12. HYPERTENSION

Steven Asch, M.D., M.P.H.

We depended mainly on five sources in constructing quality indicators for hypertension. For screening for hypertension, we used three organizations’ published guidelines: the Canadian Task Force on Periodic Examination (CTF), the United States Preventive Services Task Force (USPSTF) and the American College of Physicians (ACP) (CTF, 1984; USPSTF, 1989; Hayward et al., 1991; Littenberg et al., 1991, in Eddy, 1991; Littenberg, 1995). For indicators of treatment and follow-up care we relied upon the Fifth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC V) and a recently published meta-analysis of 14 studies of the treatment of hypertension (NHBPEP, 1993; Collins et al., 1990). The JNC V has been endorsed by more than 30 medical specialty organizations. When these core references cited studies to support individual indicators, we have referenced the original source. When the core references were unclear in their support for a particular indicator, we performed a narrow MEDLINE search for articles addressing that topic.

IMPORTANCE

Hypertension is one of the most common medical conditions. About 30 percent of adults suffer from it, perhaps as many as 58 million people in all (USPSTF, 1989). Most of the morbidity from hypertension derives from the damage it does to target organs. Epidemiologic studies have shown hypertension to be a strong risk factor for two of the leading causes of death in the United States: cardiovascular disease and cerebrovascular disease. Uncontrolled hypertension also damages the retina and kidney (USPSTF, 1989). Hypertension often goes undetected and inadequately treated. The second National Health and Nutrition Survey (NHANES II) found that among hypertensive adults, 54 percent were aware of their condition, 33 percent took medications for it, and only 11 percent were under control (NHBPEP, 1985). Hypertension is also a costly disease; patients under treatment spend about $900-$1400 annually
for drugs, laboratory tests, and provider visits (Hilleman et al., 1994).

**EFFICACY AND/OR EFFECTIVENESS OF INTERVENTIONS**

**Screening**

No randomized trials or observational studies have directly evaluated screening unselected patients for hypertension. Nonetheless, based on the demonstrated efficacy of treatment (see below), several widely accepted guidelines have been promulgated. The USPSTF recommends that all adults undergo blood pressure screening every 2 years for those with diastolic and systolic blood pressures below 85 mm Hg and 140 mm Hg, respectively, and every year for those with diastolic blood pressures of 85-89 mm Hg. The ACP makes no recommendations about the frequency of blood pressure measurement, but urges screening of all patients presenting for care. The CTF recommends that blood pressure be measured at every medical visit. (USPSTF, 1989; Littenberg et al., 1991, in Eddy, 1991; Hayward et al., 1991; Littenberg, 1995; CTF, 1984).

Estimates of the cost-effectiveness of screening patients for hypertension vary widely. While the screening test itself poses little risk to the patient’s health, incorrectly labeling a patient as hypertensive may. Searching for secondary causes of hypertension may entail some invasive procedures and pharmacologic therapy may have side effects. Cost-effectiveness studies have supported case finding (the measurement of blood pressure in patients presenting for care for other reasons) over mass screening, finding that each quality-adjusted life-year saved costs about $15,000 (Weinstein, 1976). More recent studies have estimated the cost-effectiveness of screening middle-aged women to be in the range of $23,000 per quality-adjusted life year (Littenberg et al., 1991, in Eddy, 1991; Littenberg, 1995).

**Initial Evaluation**

**Measurement Technique**

The measurement of systolic and diastolic blood pressure using a mercury sphygmomanometer cuff is one of the oldest objective measures in medicine. Because its use predated modern experimental design, it is
difficult to assess its efficacy. Studies have shown some difficulties in cuff measurements of the blood pressure of obese and elderly patients when compared to more invasive and impractical intra-arterial measurements, but virtually all studies of the natural history and treatment of the disease have been based on cuff measurements.

**Classification**

The JNC V introduced a new diagnostic staging system based on the degree of elevation of cuff measurements, which is shown in Table 12.1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (mm Hg)</th>
<th>Diastolic (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;130</td>
<td>&lt;85</td>
</tr>
<tr>
<td>High normal</td>
<td>130-139</td>
<td>85-89</td>
</tr>
<tr>
<td>Stage 1 (mild)</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2 (moderate)</td>
<td>160-179</td>
<td>100-109</td>
</tr>
<tr>
<td>Stage 3 (severe)</td>
<td>180-209</td>
<td>110-119</td>
</tr>
<tr>
<td>Stage 4 (very severe)</td>
<td>&gt;210</td>
<td>&gt;120</td>
</tr>
</tbody>
</table>


**Diagnosis**

Natural history studies of mild hypertension and the placebo arms of interventional studies have shown extreme variability in the blood pressures of Stages 1 to 2 hypertensives (Management Committee of the Australian National Blood Pressure Study, 1980; Medical Research Council Working Party, 1985). For that reason, the JNC V recommends using the average of three measurements documented over the course of several weeks to confirm the diagnosis.

**Initial History and Physical**

The initial history and physical of the newly diagnosed hypertensive patient searches for secondary causes, target organ disease and additional cardiac risk factors. A focused literature search revealed no direct evaluation of the value of the history and physical in preventing complications or death, so we have relied upon expert
opinion. We modified the recommendations in the JNC V consensus statement to produce our proposed quality indicators.

**Initial Laboratory Examination**

Like the initial history and physical, initial laboratory tests search for secondary causes, target organ damage, and other cardiac risk factors. In addition, these tests may serve as a baseline for monitoring the side effects of pharmacotherapy. A focused literature review again revealed no direct evaluation of routine testing, so we again modified the JNC V recommendations when constructing our indicators.

**Secondary Hypertension Due to Drugs**

Clinical trials have associated many drugs with the development of hypertension, including oral contraceptives, steroids, nasal decongestants, appetite suppressants, cyclosporine, erythropoietin, tricyclic antidepressants, and monamine oxidase inhibitors. The JNC V recommends the discontinuation of these drugs (at least temporarily) to determine if they are the cause of the patient’s hypertension.

**Treatment**

**Lifestyle Changes**

Most experts recommend nonpharmacologic lifestyle changes (e.g., weight reduction, low sodium diet, physical activity, alcohol avoidance) as the first line of treatment in Stage 1-3 hypertension. The evidence for such recommendations is fairly solid. An observational trial of 301 obese patients revealed significant declines in blood pressure in those who successfully lost weight (Schotte and Stunkard, 1990). A randomized trial of 878 Stage 1-2 patients who were more than 10 percent above their ideal body weight showed that weight loss enhances the antihypertensive effect of medication (Langford et al., 1991). Avoiding dietary sodium reduces systolic blood pressure by an average of 4.9 mm Hg and diastolic blood pressure by 2.6 mm Hg according to a meta-analysis of 23 randomized trials with 1536 subjects (Cutler et al., 1991). Patients with low levels of physical fitness, as measured by treadmill, developed hypertension 1.5 times more often in a cohort of 4820 men and 1219 women observed for 4 years (Blair et al., 1984).
Epidemiologic studies have linked excessive alcohol consumption and hypertension. In addition, a randomized controlled trial of 41 heavy drinkers supports this association. Though this randomized trial was plagued by a high dropout rate, it demonstrated that physicians simply advising patients to reduce their alcohol consumption resulted in an average drop of more than 5 mm Hg in systolic blood pressure (Maheswaran et al., 1991).

**Pharmacotherapy**

If nonpharmacologic measures do not lower the blood pressure to normal levels or if the patient has Stage 4 disease, the JNC V recommends the addition of medication to the patient’s regimen. A meta-analysis of 14 randomized trials has demonstrated a 42 percent reduction in strokes, a 14 percent reduction in coronary heart disease and a 12 percent reduction in all-cause mortality over 4-6 years of follow-up (Collins et al., 1990; Hebert et al., 1988). These studies have predominantly used middle-aged or elderly men as subjects, somewhat limiting their application to women (Anastos et al., 1991). The benefits of pharmacologic treatment are most pronounced among those with Stage 4 hypertension, increasing five-year survival from close to zero to 75 percent (Hansson, 1988).

**Choice of Pharmacologic Agent**

Although many classes of drugs (e.g., angiotensin-converting enzyme inhibitors, calcium channel blockers, direct vasodilators, centrally acting alpha antagonists) have been proven effective at lowering blood pressure, only beta blockers and diuretics have demonstrated in randomized controlled trials that they effectively lower mortality. Indeed, recent observational data have given rise to the suspicion that calcium channel blockers may increase overall mortality (Psaty et al., 1995). All 14 trials cited in the above meta-analysis used beta blockers or diuretics to lower the blood pressure of the intervention group. While awaiting data expected in 2001 from ALLHAT (Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack), a randomized trial evaluating ACE inhibitors, calcium channel blockers, centrally acting agents and cardiovascular morbidity and mortality, the
JNC V recommended initial pharmacologic therapy with either a diuretic or a beta blocker.

**Concomitant Disease**

The presence of concomitant disease may alter this JNC V recommendation. Both beta blockers and thiazide diuretics are associated with mild increases in serum lipids, though this effect has not been shown to persist (Grimm et al., 1981). For that reason, some experts recommend avoiding these agents in patients with known hyperlipidemia. Similarly, diabetics under treatment should avoid beta blockers because of the masking of hypoglycemic symptoms. Several randomized trials have shown ACE inhibitors and calcium channel blockers to delay the progression of diabetic nephropathy (Lederle, 1992; Baba et al., 1986; Bjarck et al., 1986; Marre et al., 1988; Hommel et al., 1986). Asthmatic patients should avoid beta blockers due to their bronchoconstrictive effect (Barker et al., 1991). Many thiazide diuretics increase uric acid and should thus be avoided as initial therapy for patients with gout (Barker et al., 1991). Patients with known coronary artery disease but no dilated cardiomyopathy (likely to be a rare group in our study population), should receive beta blockers preferentially over diuretics as initial therapy. Several randomized controlled trials have demonstrated that beta blockers reduce mortality in such patients (First International Study of Infarct Survival Collaborative Group, 1988).

**Follow-up**

No studies directly address the optimal follow-up period for hypertensive patients. The JNC V recommends two visits each year. The goal of antihypertensive therapy is to lower the blood pressure to normal levels. If hypertension persists despite treatment, most experts recommend altering the patient’s regimen. However, there is no consensus as to the optimal algorithm for modifying the regimen. Increasing the dose, changing to another class of agents, adding an agent from another class, reducing the frequency of administration to improve compliance, and renewed efforts at lifestyle modification are all acceptable strategies.
### RECOMMENDED QUALITY INDICATORS FOR HYPERTENSION

These indicators apply to nonpregnant women age 18-50.

#### Diagnosis

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screening</strong></td>
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</tr>
<tr>
<td>1. Systolic and diastolic blood pressure should be measured on adult women otherwise presenting for care at least once each year.</td>
<td>III</td>
<td>USPSTF, 1989; Hayward et al., 1991; Littenberg et al., 1991, in Eddy, 1991; Littenberg, 1995; CTF, 1984</td>
<td>Decrease hypertensive complications.*</td>
<td>Blood pressure measurement has been recommended by three widely accepted guidelines. Increased detection of asymptomatic hypertensives prompts treatment.</td>
</tr>
</tbody>
</table>

| **Initial Assessment** | | | | |
| 2. Patients with a new diagnosis of stage 1-3 hypertension should have at least three measurements on different days with a mean SBP>140 and/or a mean DBP>90. | III | Management Committee of the Australian National Blood Pressure Study, 1980; Medical Research Council Working Party, 1985 | Prevent medication side effects such as orthostatic hypotension, fatigue, and impotence. | Observational studies have shown variability in the blood pressure of patients with mild to moderate hypertension. False labeling of patients as hypertensive can lead to unnecessary treatment and potential medication side effects. |
| 3. Initial history and physical of patients with hypertension should document assessment of at least two items from each of the following groups by the third visit: a. Family or personal history of premature CAD, CVA, diabetes, hyperlipidemia; b. Personal history of tobacco abuse, alcohol abuse, or taking of medications known to cause hypertension;** and c. Examination of the fundi, heart sounds, abdomen for bruits, peripheral arterial pulses, neurologic system. | III | NHBPEP, 1993 | Reduce or eliminate medication side effects. Prevent other symptoms from the underlying disease (e.g., renal failure from renal artery stenosis). Decrease synergistic risk of cardiovascular complications.* Prevent hypertensive complications.* | No controlled trials directly examine the elements of quality in the history and physical for hypertensives. These minimum recommendations from JNC V search for secondary causes, other cardiac risk factors, and target organ damage. Identification of secondary causes can eliminate the need for therapy. Staging of target organ damage should prompt more aggressive control of hypertension for advanced disease. |
4. Stage 1 hypertensive women taking drugs known to cause hypertension** should have the drug discontinued (at least temporarily) before pharmacotherapy is initiated.

<p>| | | | |</p>
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<tbody>
<tr>
<td></td>
<td>I</td>
<td>NHBPEP, 1993</td>
<td>Prevent or reduce medication side effects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clinical trials have associated many drugs with hypertension. The JNC V recommends discontinuation of the implicated drugs to determine if they are causing hypertension. Drugs known to cause hypertension include: oral contraceptives, steroids, nasal decongestants, appetite suppressants, cyclosporine, monamine oxidase inhibitors, tricyclic antidepressants, and erythropoietin.</td>
</tr>
</tbody>
</table>

5. Initial laboratory tests should include at least 5 of the following:
   a. Urinalysis,
   b. Glucose,
   c. Potassium,
   d. Calcium,
   e. Creatinine,
   f. Uric acid,
   g. Cholesterol,
   h. Triglyceride,
   i. Electrocardiogram, and
   j. Echocardiogram.

<p>|   | III | NHBPEP, 1993 | Reduce or eliminate medication side effects. Prevent other symptoms from the underlying disease (e.g., renal failure from renal artery stenosis). Decrease synergistic risk of cardiovascular complications.* Prevent hypertensive complications.* |
|   |   |   | No clinical trials directly examine the efficacy of initial laboratory testing for hypertensive patients. These minimum recommendations from JNC V search for secondary causes, other cardiac risk factors, and end organ damage. |</p>
<table>
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<th>Benefits</th>
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</tr>
</thead>
<tbody>
<tr>
<td>6. First-line treatment for Stage 1-3 hypertension is lifestyle modification. The medical record should indicate counseling for at least one of the following interventions prior to pharmacotherapy: weight reduction, increased physical activity, low sodium diet, or alcohol intake reduction.</td>
<td>I-II</td>
<td>Schotte and Stunkard, 1990; Langford, 1991; Blair et al., 1984; Cutler et al., 1991; Maheswaran et al., 1991</td>
<td>Avoids side effects of medical therapy. Decreases hypertensive complications.</td>
<td>Cohort data from 301 obese patients showed weight loss reduces blood pressure and a randomized trial of 878 obese patients showed that weight loss enhances antihypertensive pharmacotherapy. A meta-analysis of 23 randomized trials demonstrated that lowering dietary sodium lowers blood pressure. Cohort observational data indicates that sedentary patients develop hypertension more frequently. A randomized trial demonstrated that advising alcoholics to reduce their drinking reduced their blood pressure.</td>
</tr>
<tr>
<td>7. First-line pharmacotherapy for Stage 1-3 hypertension is monotherapy with thiazide diuretics or beta blockers. The medical record should show failure on one of these agents or a contraindication*** before initiation of therapy with other agents.</td>
<td>I</td>
<td>Collins, 1990; Hebert, 1988; JNC V, 1993</td>
<td>Decreased hypertensive complications.</td>
<td>A meta-analysis of 14 randomized trials using these agents showed a 42% reduction in stroke, a 14% reduction in coronary heart disease, and a 12% reduction in mortality.</td>
</tr>
<tr>
<td>8. First-line pharmacotherapy for diabetics should include an ACE inhibitor or a calcium channel blocker.</td>
<td>I</td>
<td>Lederle, 1992; Baba, 1987; Bjorck, 1986; Marre, 1988; Hommel, 1986</td>
<td>Decreased hypertensive complications (particularly nephropathy).</td>
<td>Randomized trials have shown these agents to reduce progression of proteinuria and diabetic nephropathy.</td>
</tr>
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Follow-up

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>9. Hypertensive patients should visit the physician at least twice each year.</td>
<td>III</td>
<td>NHBPEP, 1993</td>
<td>Reduce hypertensive complications and medication side effects.</td>
<td>JNC V recommendations.</td>
</tr>
<tr>
<td>10. Hypertensive patients with persistent elevations of SBP&gt;160 or DBP&gt;90 should have one of the following interventions recorded in the medical record: a. Change in dose or regimen of antihypertensives; or b. Repeated education regarding lifestyle modifications,</td>
<td>III</td>
<td>NHBPEP, 1993</td>
<td>Decrease hypertensive complications.</td>
<td>JNC V recommendations.</td>
</tr>
</tbody>
</table>

* Hypertensive complications include: cardiovascular disease, cerebrovascular disease, retinopathy and nephropathy. Cardiovascular disease can result in chest pain, shortness of breath, claudication, fatigue, and death. Cerebrovascular disease can result in neurologic symptoms (e.g., aphasia, paralysis) and death. Retinopathy can result in visual field defects and blindness. Nephropathy can result in edema, arrhythmias, nausea, vomiting, fatigue, dialysis, and death.

**Drugs known to cause hypertension include: oral contraceptives, steroids, nasal decongestants, appetite suppressants, cyclosporine, monamine oxidase inhibitors, tricyclic antidepressants, and erythropoietin.

***Relative contraindications to thiazide diuretics include hyperlipidemia and gout; relative contraindications to beta blockers include hyperlipidemia, diabetes and asthma.

NOTE: Stages 1-4 hypertension are defined as listed below. See Table 12.1 for the complete high blood pressure diagnostic staging system.

<table>
<thead>
<tr>
<th>Stage of Hypertension</th>
<th>Systolic, mm Hg</th>
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<td>Stage 4 (very severe)</td>
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</tr>
</tbody>
</table>

Quality of Evidence Codes:

I: RCT
II-1: Nonrandomized controlled trials
II-2: Cohort or case analysis
II-3: Multiple time series
III: Opinions or descriptive studies
REFERENCES – HYPERTENSION


